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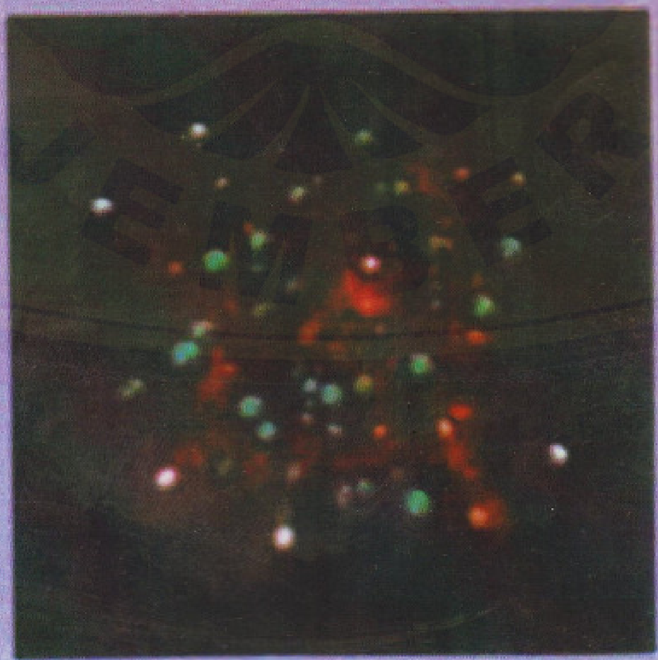

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The 2nd International Conference of Combinatorics, Graph Theory, and Network Topology

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The Second International Conference on Combinatorics, Graph Theory, and Network Topology 2018

Dafik

Editor in Chief of International Conference on Combinatorics, Graph Theory, and Network Topology 2018
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We would like to express our gratitude to all participant who were joining "The Second International Conference on Combinatorics, Graph Theory, and Network Topology (ICCGANT)". It is the 2nd International conference held by the CGANT Research Group held by University of Jember in cooperation with Indonesian Combinatorics Society (INACOBMS) on 24-25 November 2018. The conference is held to welcome participants from many countries, with broad and diverse research interests of mathematics especially combinatorical study. The mission is to become an annual international forum in the future, where, civil society organization and representative, research students, academics and researchers, scholars, scientist, teachers and practitioners from all over the world could meet in and exchange an idea to share and to discuss theoretical and practical knowledge about mathematics and its applications. The aim of the second conference is to present and discuss the latest research that contributes to the sharing of new theoretical, methodological and empirical knowledge and a better understanding in the area mathematics, application of mathematics as well as mathematics education. The themes of this conference are as follows: (1) Connection of distance to other graph properties, (2) Degree/diameter problem, (3) Distance-transitive and distance-regular graphs, (4) Metric dimension and related parameters, (5) Cages and eccentric graphs, (6) Cycles and factors in graphs, (7) Large graphs and digraphs, (8) Spectral Techniques in graph theory, (9) Ramsey numbers, (10) Dimensions of graphs, (11) Communication networks, (12) Coding theory, (13) Cryptography, (14) Rainbow connection, (15) Graph labelings and coloring, (16) Applications of graph theory. The topics are not limited to the above themes but they also include the mathematical application research of interest in general including mathematics education, such as: (1) Applied Mathematics and Modelling, (2) Applied Physics: Mathematical Physics, Biological Physics, Chemistry Physics, (3) Applied Engineering: Mathematical Engineering, Mechanical engineering, Informatics Engineering, Civil Engineering, (4) Statistics and Its Application, (5) Pure Mathematics (Analysis, Algebra and Geometry), (6) Mathematics Education, (7) Literacy of Mathematics, (8) The Use of ICT Based Media In Mathematics Teaching and Learning, (9) Technological, Pedagogical, Content Knowledge for Teaching Mathematics, (10) Students Higher Order Thinking Skill of Mathematics, (11) Contextual Teaching and Realistic Mathematics, (12) Science, Technology, Engineering, and Mathematics Approach, (13) Local Wisdom Based Education: Ethnomathematics, (14) Showcase of Teaching and Learning of Mathematics, (16) The 21st Century Skills: The Integration of 4C Skill in

Teaching Math.

The participants of this ICCGANT 2018 were 375 participants consisting research students, academics and researchers, scholars, scientist, teachers and practitioners from many countries. The selected papers to be published on IOP Conference Series: Journal of Physics are 110 papers.

On behalf of the organizing committee, finally we gratefully acknowledge the support from the University of Jember of this conference. We would also like to extend our thanks to all lovely participants who have been joining this unforgettable and valuable event..

Prof. Dafik, M.Sc., Ph.D.

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The committees of the Second International Conference on Combinatorics, Graph Theory, and Network Topology would like to express gratitude to all Committees for the volunteering support and contribution in the editing and reviewing process.

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The local (adjacency) metric dimension of split related complete graph

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The local (adjacency) metric dimension of split related complete graph

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Abstract. Let G be a simple graph. A set of vertices, called $V(G)$ and a set of edges, called $E(G)$ are two sets which form graph G. W is a local adjacency resolving set of G if for every two distinct vertices x, y and x adjacent with y then $rA(x|W) \neq rA(y|W)$. A minimum local adjacency resolving set in G is called local adjacency metric basis. The cardinality of vertices in the basis is a local adjacency metric dimension of G ($dim_{A,l}(G)$). We present the exact value of local adjacency metric dimension of m-splitting complete and bipartite graphs.

1. Introduction

This research in this paper uses simple and connected graphs. A set of vertices, called $V(G)$ and a set of edges, called $E(G)$ are two sets which form graph G. [4], [5], [6], [7], [2] A split graph is a graph derived by adding new vertex v' in every vertex v such that v' adjacent to v in graph G. An m-splitting graph is a graph which has m v'-vertices, denoted by $_mSpl(G)$. [3] The local adjacency metric dimension is one of graph topic. Suppose there are three neighboring vertex a, b, c in path $a - c$. Path $a - c$ is called *local* if a, b, c where each has representation: a is not equals b and a may equals c. [1] Let's say, $x, y \in G$. For an order set of vertices $W = \{w_1, w_2, \ldots, w_k\}$, the adjacency representation of v with respect to W is the ordered k-tuple $rA(x|W) = (dA(x, w_1), dA(x, w_2), \ldots, dA(x, w_k))$, where $dA(x, w)$ represents the adjacency distance $x - w$. $dA(x, w)$ defined by 0 if $x = w_i$, 1 if x adjacent with w, and 2 if x does not adjacent with w. W is a local adjacency resolving set of G if for every two distinct vertices x, y and x adjacent with y then $rA(x|W) \neq rA(y|W)$. A minimum local adjacency resolving set in G is called local adjacency metric basis. The cardinality of vertices in the basis is a local adjacency metric dimension of G ($dim_{A,l}(G)$).

2. Result

2.1. m−Splitting of Complete Graph

A $m-$splitting of complete graph ($_mSpl(K_n)$) is a graph obtained from a complete graph (K_n) by adding new vertex v' in every vertex v as n such that v' adjacent v in K_n. $m-$splitting graph is graph which has the number of vertex v' as m. Let $G =_m Spl(K_n)$ with vertex set

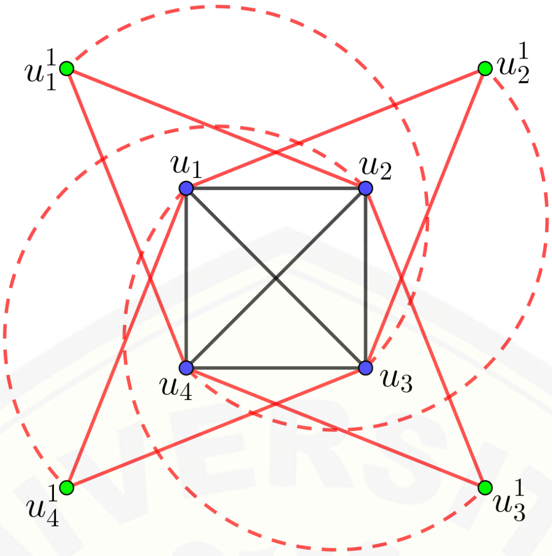

Figure 1. ${}_1Spl(K_4)$ Graph

$V(G) = \{u_1, u_2, \ldots, u_i\} \bigcup \{u_1^1, u_2^1, \ldots, u_i^k\}$, where u_i is vertex of K_n and u_i^k is copy of vertex u_i around K_n for $i \in \{1, 2, \ldots, n\}$ and $k \in \{1, 2, \ldots, m\}$. We can see at 2.1 as illustration.

Theorem 2.1: Let G be $m-$splitting of complete graph $({}_mSpl(K_n))$ with $|V(G)| = 2n$. For $n \geq 4$ and $m, n \in N$, then $dim_{A,l}(G) = n - 1$

Proof 2.1 *Choose $S = \{u_1, u_2, \ldots, u_{n-1}\} \subset V(G)$. We will show that S is a local adjacency resolving set of G. The local adjacency representations of vertices from $V(G) - S$ are as follow:*

$$\begin{aligned} r_A(u_i|S) &= (11\ldots1) \\ r_A(u_1^k|S) &= (2111\ldots1) \\ r_A(u_2^k|S) &= (1211\ldots1) \\ r_A(u_3^k|S) &= (1121\ldots1) \\ &\vdots \\ r_A(u_i^k|S) &= (11\ldots112) \end{aligned}$$

As we see that all of the adjacency representations of adjacent vertices are distinct. So, $S = \{u_1, u_2, \ldots, u_{n-1}\}$ is a local adjacency resolving set for G. The cardinality of S, $|S| = n-1$ is minimum, because if $|S| < n-1$ certainly there are $a \neq b \in V(G) - S$ such that $r(a|S) = r(b|S)$. Suppose $S_1 = \{u_1, u_2, \ldots, u_{n-2}\}$, $|S| = n-2 < n-1$. Then, $r_A(u_i|S) = (11\ldots1) = r_A(u_{i-1}|S)$ and $u_i \sim u_{i-1}$. Thus, $dim_{A,l}(G) = n - 1$. □

2.2. $m-$Splitting of Complete Bipartite Graph

A $m-$splitting of complete bipartitr graph $({}_mSpl(K_{n,t}))$ is a graph obtained from a complete bipartite graph $(K_{n,t})$ by adding new vertex v' in every vertex v as $n+t$ such that v' adjacent v in $K_{n,t}$. $m-$splitting graph is graph which has the number of vertex v' as m. Let $G =_m Spl(K_{n,t})$ with vertex set $V(G) = \{u_1, u_2, \ldots, u_i\} \bigcup \{u_1^1, u_2^1, \ldots, u_i^k\}$, where u_i is vertex of $K_{n,t}$ and u_i^k is copy of vertex u_i around $K_{n,t}$ for $i \in \{1, 2, \ldots, n+t\}$ and $k \in \{1, 2, \ldots, m\}$. We can see at 2.2, 2.2, and as illustration.

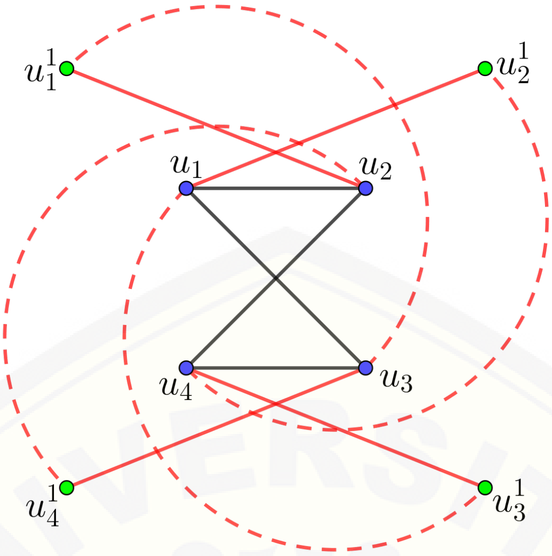

Figure 2. ${}_1Spl(K_{2,2})$ Graph

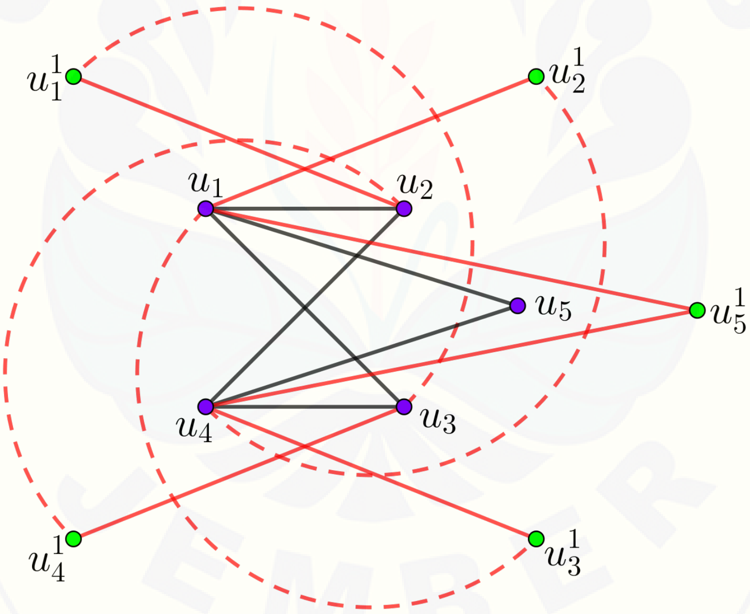

Figure 3. ${}_1Spl(K_{2,3})$ Graph

Theorem 2.2: Let G be $m-$splitting of complete bipartite graph $({}_mSpl(K_{n,t}))$ with $|V(G)| = n + t$. For $n, t > 1$ and $n, t, m \in N$, then $dim_{A,l}(G) = 1$

Proof 2.2 *We divide the proof till some cases. We prove this theorem by see the construct of the based graph, complete bipartite graph $(K_{n,t})$ for $n, t > 1$ and $n, t, m \in N$.*

(i) Case 1. For $n = t$. Choose $S = \{a_1\} \subseteq V(G)$. We will show that S is a local adjacency

resolving set of G. We know that d is defined by

$$d(u,w)=\begin{cases}0 & \text{if } v=w\ ;\\ 1 & \text{if } v \text{ adjacent with } w;\\ 2 & \text{if } v \text{ does not adjacent with } w.\end{cases}$$

Suppose we call the "inside" vertices of G is the set of vertices in $K_{n,t}$ and the "outside" vertices of G is the set of vertices outside $K_{n,t}$ (or in $m-$split of $K_{n,t}$). Based on the construction of $K_{n,t}$, then there are three cases to prove the theorem, such that:

(a) *When the resolving vertices set are inside the G. Choose resolving vertice of S as much as 1. Suppose we put any vertices of S inside G. Based on the construction of $K_{n,t}$, every vertex in (v_i^k) has neighbour as (v_i). Suppose we have (v_b) for $b \in \{1,2,\dots,n\}$ and (v_c) for $c \in \{1,2,\dots,t\}$. When we put a_1 in (v_b) then every vertex in (v_c) and (v_c^k) has same r such that 1. Otherwise, every vertex in (v_b) and (v_b^k)has same r such that 2 except $r(a_1)=0$. But every vertex in (v_c) or (v_b) is not adjacent. Then it ensures that all vertices in S are distinct.*

(b) *When the resolving vertices set are outside the G. Choose resolving vertices of S as much as 1. Suppose we put any vertices of S outside G. Without loss the generality, let j be even number of N. Let $v_i^k, v_{i+2}^k, \dots v_{i+j}^k$ in S. Then there must be minimum an outside vertex (v_{i+1}^k) adjacent to inside vertex (v_i) which have same $r=(2)$.*

Based on two points above, we focus in the first point of case. As we see that all of the adjacency representations of adjaceny vertices are distinct. So, $S=\{a_1\}$ is a local adjacency resolving set for G. The cardinality of S, $|S|=1$ is minimum. Thus, $dim_{A,l}(G)=1$ for $n=t$.

(ii) *Case 2. For n is odd and r is even and otherwise. Choose $S=\{a_1\}\subseteq V(G)$. We will show that S is a local adjacency resolving set of G. We know that d is defined by*

$$d(u,w)=\begin{cases}0 & \text{if } v=w\ ;\\ 1 & \text{if } v \text{ adjacent with } w;\\ 2 & \text{if } v \text{ does not adjacent with } w.\end{cases}$$

Suppose we call the "inside" vertices of G is the set of vertices in $K_{n,t}$ and the "outside" vertices of G is the set of vertices outside $K_{n,t}$ (or in $m-$split of $K_{n,t}$). Based on the construction of $K_{n,t}$, then there are three cases to prove the theorem, such that:

(a) *When the resolving vertices set are inside the G. Choose resolving vertice of S as much as 1. Suppose we put any vertices of S inside G. Based on the construction of $K_{n,t}$, every vertex in (v_i^k) has neighbour as (v_i). Suppose we have (v_b) for $b \in \{1,2,\dots,n\}$ and (v_c) for $c \in \{1,2,\dots,t\}$. When we put a_1 in (v_b) then every vertex in (v_c) and (v_c^k) has same r such that 1. Otherwise, every vertex in (v_b) and (v_b^k)has same r such that 2 except $r(a_1)=0$. But every vertex in (v_c) or (v_b) is not adjacent. Then it ensures that all vertices in S are distinct.*

(b) *When the resolving vertices set are outside the G. Choose resolving vertices of S as much as 1. Suppose we put any vertices of S outside G. Without loss the generality, let j be even number of N. Let $v_i^k, v_{i+2}^k, \dots v_{i+j}^k$ in S. Then there must be minimum an outside vertex (v_{i+1}^k) adjacent to inside vertex (v_i) which have same $r=(2)$.*

Based on two points above, we focus in the first point of case. As we see that all of the adjacency representations of adjaceny vertices are distinct. So, $S=\{a_1\}$ is a local adjacency resolving set for G. The cardinality of S, $|S|=1$ is minimum. Thus, $dim_{A,l}(G)=1$ for n is odd and r is even and otherwise.

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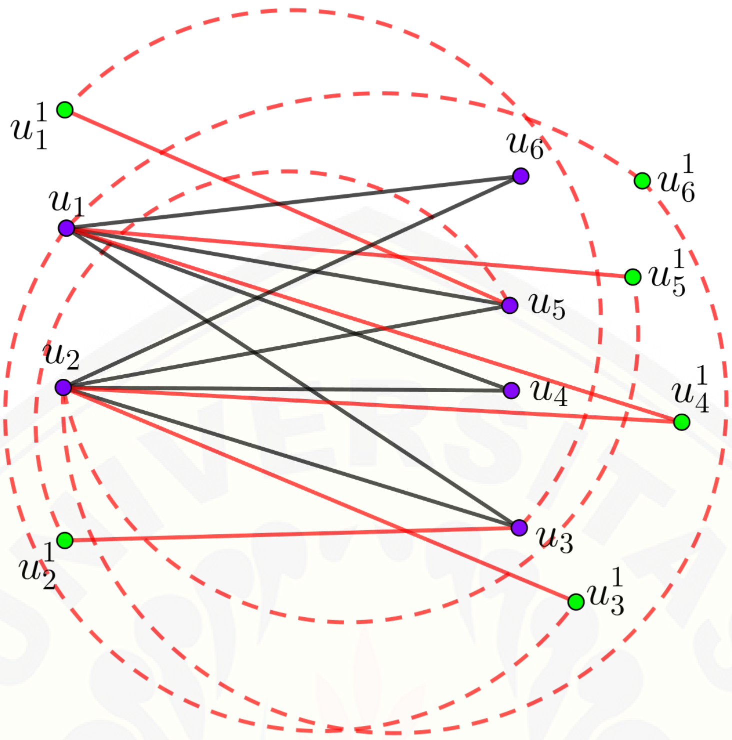

Figure 4. ${}_1Spl(K_{2,4})$ Graph

(iii) Case 3. For n and r are even or for n and r are odd. Choose $S = \{a_1\} \subseteq V(G)$. We will show that S is a local adjacency resolving set of G. We know that d is defined by

$$d(u,w) = \begin{cases} 0 & \text{if } v = w\ ; \\ 1 & \text{if } v \text{ adjacent with } w; \\ 2 & \text{if } v \text{ does not adjacent with } w. \end{cases}$$

Suppose we call the "inside" vertices of G is the set of vertices in $K_{n,t}$ and the "outside" vertices of G is the set of vertices outside $K_{n,t}$ (or in $m-$split of $K_{n,t}$). Based on the construction of $K_{n,t}$, then there are three cases to prove the theorem, such that:

(a) When the resolving vertices set are inside the G. Choose resolving vertice of S as much as 1. Suppose we put any vertices of S inside G. Based on the construction of $K_{n,t}$, every vertex in (v_i^k) has neighbour as (v_i). Suppose we have (v_b) for $b \in \{1, 2, \dots, n\}$ and (v_c) for $c \in \{1, 2, \dots, t\}$. When we put a_1 in (v_b) then every vertex in (v_c) and (v_c^k) has same r such that 1. Otherwise, every vertex in (v_b) and (v_b^k)has same r such that 2 except $r(a_1) = 0$. But every vertex in (v_c) or (v_b) is not adjacent. Then it ensures that all vertices in S are distinct.

(b) When the resolving vertices set are outside the G. Choose resolving vertices of S as much as 1. Suppose we put any vertices of S outside G. Without loss the generality, let j be even number of N. Let $v_i^k, v_{i+2}^k, \dots v_{i+j}^k$ in S. Then there must be minimum an outside vertex (v_{i+1}^k) adjacent to inside vertex (v_i) which have same $r = (2)$.

Based on two points above, we focus in the first point of case. As we see that all of the adjacency representations of adjaceny vertices are distinct. So, $S = \{a_1\}$ is a local adjacency *resolving set for G. The cardinality of S, $|S| = 1$ is minimum. Thus, $dim_{A,l}(G) = 1$ for n and r are even or for n and r are odd.*

□

3. Concluding Remark

We have discussed about the local adjacency metric dimension of some m splitting related wheel graphs for several sets of value (n, t, m) in this paper. Two basic theorems are about complete graph and complete bipartite graph which has any solutions for being a basic graph of operation m splitting.

Open Problem

Find local adjacency metric of ${}_mSpl(H_n)$ graph for any n and m where H is any graph.

Acknowledgement

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