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VE-Fuzzy Generalised Mean and Variance

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Abstract: A data consists of several values (called data points) and the aim of Statistical analysis is to explore or describe the data values to illicit valuable information of it. Suresh Kumar [1] introduced the Generalised Arithmetic mean and the Generalised Geometric mean. Suresh Kumar and Sarika M Nair [2] studied them in detail and extended the work to the Generalised Variance and the Generalised covariance and the Generalised Correlation coefficient. Suresh Kumar and Sunil M.P. [5] extended these concepts to fuzzy graphs by taking the fuzzy membership grades of the edges (inter-relationship of the data values) into account. In this paper, we investigate the notion of the Fuzzy Generalised Mean, the Fuzzy Generalised Variance, the Fuzzy Generalised Covariance and Fuzzy Generalised Correlation by taking into account the fuzziness of both the vertex and the edge membership grades to explore the Non-linear, Fuzzy and Combinatorial relationship among the data, through Fuzzy graph models.
Keywords: Data, Fuzzy Graphs, Generalised Arithmetic Mean, Generalised Variance, Generalised Covariance,

I. INTRODUCTION

Statistical data consists of several values (called data points) and the aim of Statistical analysis is to explore or describe the data values and investigates the relationship of the data.

The disadvantage of the mean is that it is sensitive to some extreme value, especially when the sample size is small. So, it is not an appropriate measure of central tendency for the skewed distribution. For example, in a company in which a few employees draw cadre wise salaries plus allowances and performance based incentives, the usual mean will not give any realistic measure of the employee's average monthly income.

In many situations, the Fuzziness also needs to be considered since the employees are subject to variation by firing or self-movement. Sunil M.P. and J. Suresh Kumar [3, 4] studied the fuzzy graphs and showed how they can be used to accommodate the fuzziness in the distance concept in Graphs. In the modern new-generation business Environment, there are several layers of employees like Managers, Advisors, Sales Representatives etc. so that there is an inter-relationship (usually Hierarchical) among the employees as well so that the actual monthly income of an employee depends on the amount of business capital generated by that person,.

The Fuzzy Generalised Arithmetic mean (FGAM) can be used for the data where some data points are more important than some other values so that they shall contribute more to the final "average" and it also gives the inter-relationships among the data values and the degree of Fuzziness of the pints and their relationships as well.

In a University, various courses have to be awarded credit points depending on their relevance and applicability to the core discipline. Professors or teachers handling the curriculum design shall assign credits to the courses, The courses and their relationships are Fuzzy if rapid changes or advancements in the courses are accommodated in time. The Fuzzy Generalised Arithmetic mean can be effectively used when calculating a credit for a specific course by seeing the connections among the various courses.

The Fuzzy Generalised Arithmetic Mean is similar to an ordinary arithmetic mean with an exception that instead of each data point contribute equally to the final average, some data points are inter-related to many others and thus contribute more than others. This concept plays a vital role in descriptive statistics and also occurs in a more general form in several other areas of applied mathematics. When the weights of all data points are equal, then the Fuzzy Generalised Arithmetic Mean is the same as the usual arithmetic mean.

Covariance is a statistical measure in Correlation analysis to explore the "Linear" relationship among the data. We propose the notion of the Fuzzy Generalised Covariance to give an approach of Non-linear "Combinatorial" relationship among the data, through Fuzzy graph models. For statistical terms and notations not explicitly mentioned, reader may refer VK Rohatgi [6]. For graph terms and notations not explicitly mentioned, reader may refer Harary [7].

II. MAIN RESULTS

A. VE-Fuzzy Generalized Arithmetic Mean (VEFGAM)

Arithmetic mean of a set numbers $a_1, a_2, \dots a_n$ represents average measure of the central tendency and is defined as $(a_1 + a_2 + \cdots + a_n)/n$ and is referred to as AM. The weighted Arithmetic mean of a set numbers $a_1, a_2, \dots a_n$ with weights $w, w_2, \dots w_n$ is given by $\frac{1}{n}\sum_{i=1}^{n} a_i w_i$

The Fuzzy Generalized Arithmetic mean (FGAM) can be used for the data where some data points or the relationships among them are fuzzy so that vertices contribute differently to the final "average". In this paper, while calculating it, we consider the fuzziness of the relationships among the data values (in terms of vertex memberships) as well as among their mutual relationships (in terms of edge memberships).

1) *Definition.* Let $a_1, a_2 \dots \dots . a_n$ be a given set of numbers. Consider a fuzzy graph $G = (V, \sigma, \mu)$ with n vertices and assign these numbers as its vertex labels. For any edge $\{v_i, v_j\}$ of the graph G, assign the label $\left[\mu(v_i, v_j)\left(\sigma(v_i)\, a_i + \sigma(v_j)\, a_j\right)\right]/n$. Then VE-Fuzzy Generalized Arithmetic Mean (VEFGAM) is defined as the sum of all the edge labels of G and is denoted by VEFGAM(G). We recall that the degree of a vertex, v, in a Fuzzy graph G is the sum of the membership values of the edges incident at v.

2) *Theorem.* For a Fuzzy graph $G = (V, \sigma, \mu)$ with vertex degrees, $d_1, d_2 \dots \dots . . d_n$, $VEFGAM(G) = \sum_{i=1}^{n} a_i d_i / n$.

a) *Proof:* For an edge $\{v_i, v_j\}$ of G, we are assigns the label $\left[\mu(v_i, v_j)\left(\sigma(v_i)\, a_i + \sigma(v_j)\, a_j\right)\right]/n$. Thus the contribution of the vertex v_i is $\mu(v_i, v_j)\, \sigma(v_i)\, a_i / n$ for this edge. Hence, if we count the sum of all the edge labels of G, then each vertex v_i with degree $d_i = \sum_{v_j} \mu(v_i, v_j)$ contribute $\sigma(v_i) d_i a_i / n$ to the sum of the edge labels of all edges of the graph. Hence Fuzzy Generalised Arithmetic mean is $\sum_{i=1}^{n} \sigma(v_i)\, a_i d_i / n$.

The following corollaries are immediate from the above theorem.

3) *Corollary.* For 1-Regular graph, VEFGAM is same as the weighted AM of a set of numbers with $\sigma(v_i)$ as the weight of v_i.

4) *Corollary.* For 2-Regular graph, VEFGAM will be twice that of the weighted AM of a set of numbers with $\sigma(v_i)$ as the weight of v_i.

5) *Corollary.* For a k-regular graph, VEFGAM of a set of numbers is k times that of the weighted AM of a set of numbers with $\sigma(v_i)$ as the weight of v_i.

The following is a bound for Fuzzy Generalised Arithmetic Mean of a given set of numbers.

6) *Corollary.* For a Fuzzy graph G with n vertices, $FGAM(G) \leq (n-1)AM$

a) *Proof.* Since for a graph G with vertex degrees, $d_1, d_2 \dots \dots . . d_n$, Fuzzy Generalised Arithmetic mean is given by $\sum_{i=1}^{n} a_i d_i / n$. Also the FGAM is the maximum when $d_1, d_2 \dots \dots . . d_n$ have the maximum value, which is (n-1). Hence, the inequality follows. The complement of the Fuzzy graph $G = (V, \sigma, \mu)$ is defined as the Fuzzy graph, $G' = (V, \sigma', \mu')$, where $\sigma'(v) = 1 - \sigma(v), \mu'(\{u, v\}) = 1 - \mu(\{u, v\})$ Now we proceed to investigate the Nordhaus-Gaddum type result for the graph parameter, the Fuzzy Generalised Arithmetic Mean. Let G be a graph with vertex degrees, $d_1, d_2 \dots \dots . . d_n$ so that $\bar{G}$ is the graph with vertex degrees, $n-1-d_1, n-1-d_2 \dots \dots . . n-1-d_n$. Then the Fuzzy Generalised Arithmetic mean of the numbers $a_1, a_2 \dots \dots . a_n$ with respect to the graph G satisfies the same lower and upper Nordhaus-Gaddum bounds as below.

7) *Theorem.* For a graph G with n vertices, $FGAM(G) + FGAM(G') = (n-1)\, AM$

a) *Proof:* Let G be a graph with n vertices. $a_1, a_2 \dots \dots . a_n$. Any edge $\{v_i, v_j\}$ of G gets the label $\left[\mu(v_i, v_j)\left(a_i + a_j\right)\right]/n$. Thus when we calculate the Fuzzy Generalised Arithmetic mean of G, v_i contributes $\mu(v_i, v_j)\, a_i / n$. Thus v_i contribute $\sum_{v_i} \sigma(v_i)\, a_i / n = d_i a_i / n$ to the sum, $FGAM(G)$. Similarly, when we calculate the Fuzzy Generalised Arithmetic mean with respect to G', an edge $\{v_i, v_j\}$ of G' gets the label $\left[1 - \mu(v_i, v_j)\right][\left(a_i + a_j\right)]/n$. Thus when we calculate the Fuzzy Generalised Arithmetic mean of G', v_i contributes $\left[1 - \mu(v_i, v_j)\right] a_i / n$. Thus, v_i contributes $\sum_{v_j}\left[1 - \mu(v_i, v_j)\right] a_i / n = (n - 1 - d_i) a_i / n$ to the sum, $FGAM(G')$. Thus, v_i contributes $(n-1)\, a_i / n$ to the sum, $FGAM(G) + FGAM(G')$. Hence the Theorem follows.

B. Vertex-Edge-Fuzzy Generalised Geometric Mean (VEFGGM)

In this section, we introduce VE-Fuzzy Generalised Geometric mean (VEFGGM) of a graph.

1) *Definition.* Let $a_1, a_2, \dots\dots\dots a_n$ be a given set of numbers. Let $G = (V, \sigma, \mu)$ be a Fuzzy graph with n vertices and assign these numbers as its vertex labels. For any edge $\{v_i, v_j\}$, assign the label $\left(\mu(v_i, v_j)\, a_i a_j \sigma(v_i)\sigma(v_j)\right)^{1/n}$. VE-Fuzzy Generalised Geometric mean is defined as the product of the edge labels of G.
2) *Theorem.* For a graph G with vertex degrees, $d_1, d_2 \dots\dots\dots d_n$, Fuzzy Generalised Geometric mean is given by $((a_1\sigma(v_1))^{d_1}(a_2\sigma(v_2))^{d_2} \dots\dots\dots (a_n\sigma(v_n))^{d_n})^{1/n} \prod_{\{v_i,v_j\}} \left(\mu(v_i, v_j)\right)^{1/n}$

a) *Proof:* For any edge $\{v_i, v_j\}$, we assign the label:

$$\left(\mu(v_i, v_j) a_i\sigma(v_i) a_j\sigma(v_j)\right)^{1/n} = \left(\mu(v_i, v_j)\right)^{1/n} a_i{}^{1/n} a_j{}^{1/n} \sigma(vi)^{\frac{1}{n}} \sigma(vj)^{\frac{1}{n}} .$$

Hence, if we compute the product of all the edge labels of G, then each vertex v_i with degree d_i contributes$\left((a_i\sigma(v_i))^{1/n}\right)^{d_i}$ to the product of the edge labels of the graph. Also, each edge $\{v_i, v_j\}$contributes $\left(\mu(v_i, v_j)\right)^{1/n}$to the product of the edge labels of all edges of the graph. Hence the VEFGGM is given by $((a_1\sigma(v_1))^{d_1}(a_2\sigma(v_2))^{d_2} \dots\dots\dots (a_n\sigma(v_n))^{d_n})^{1/n} \prod_{\{v_i,v_j\}} \left(\mu(v_i, v_j)\right)^{1/n}$.

The following corollaries are immediate from the above theorem.

3) *Corollary.* For a 1-Regular graph, G with $\mu(v_i, v_j) = 1$ for all edges, $\{v_i, v_j\}$ of G, VEFGGM(G) is the same as the weighted GM of given set of numbers with weights, $\sigma(v_i)$.
4) *Corollary.* For a 2-Regular graph G with $\mu(v_i, v_j) = 1$ for all edges, $\{v_i, v_j\}$ of G, VEFGGM(G) is square of the weighted GM of given set of numbers with weights, $\sigma(v_i)$.
5) *Corollary.* For a k-regular graph G with $\mu(v_i, v_j) = 1$ for all edges, $\{v_i, v_j\}$ of G, $VEFGGM(G)$ is the kth power of the weighted GM of given set of numbers with weights, $\sigma(v_i)$.

The following is a useful bound for the VE-Fuzzy Generalised Geometric Mean of a set of numbers.

6) *Corollary.* For a Fuzzy graph G with n vertices, $VEFGGM(G) \le GM$

a) *Proof.* Since for a graph G with vertex degrees, $d_1, d_2 \dots\dots\dots d_n$, VE-Fuzzy Generalised Geometric mean is given by$\prod_{i=1}^{n}\left(a_i\sigma(v_i))^{1/n}\right)^{d_i} \prod_{\{v_i,v_j\}} \left(\mu(v_i, v_j)\right)^{1/n}$. Now, the required inequality follows at once since the usual Geometric mean is $\prod_{i=1}^{n}(a_i\sigma(v_i))^{1/n}$ and $0 \le \mu(v_i, v_j) \le 1$. Now we proceed to investigate the Nordhaus-Gaddum type result for the graph parameter, the VE-Fuzzy Generalised Geometric Mean. Let G be a graph with vertex degrees, $d_1, d_2 \dots\dots\dots d_n$ so that $\bar{G}$ is the graph with vertex degrees, $n-1-d_1, n-1-d_2 \dots\dots\dots n-1-d_n$. Then the VE-Fuzzy Generalised Geometric mean of the numbers $a_1, a_2 \dots\dots\dots a_n$with respect to the graph G satisfies the the same lower and upper Nordhaus-Gaddum bounds as below.

7) *Theorem.* $VEFGGM(G).VEFGGM(G') = (GM)^{n-1} \prod_{\{v_i,v_j\}} \left(\mu(v_i, v_j)[1-\mu(v_i, v_j)]\right)^{1/n}$

a) *Proof:* Let G be a graph with n vertices. $a_1, a_2 \dots\dots\dots a_n$be its vertex labels. Any edge $\{v_i, v_j\}$ of G gets the label, $\left(\mu(v_i, v_j)\right)^{1/n} (a_i\sigma(v_i))^{1/n}(a_j\sigma(v_j))^{1/n}$. So when we calculate the VE-Fuzzy Generalised Geometric mean with respect to G, each vertex v_i contribute $\left(\mu(v_i, v_j)\right)^{1/n} (a_i\sigma(v_i))^{1/n}$. Similarly, when we calculate the VE-Fuzzy Generalised Geometric mean with respect to G', each vertex v_i contributes $\left([1-\mu(v_i, v_j)]\right)^{1/n} (a_i\sigma(v_i))^{1/n}$. Thus when we calculate the product$VEFGGM(G).VEFGGM(G')$, each vertex v_i contributes $\left(\mu(v_i, v_j)\right)^{1/n} (a_i\sigma(v_i))^{1/n} .\left([1-\mu(v_i, v_j)]\right)^{1/n} (a_i\sigma(v_i))^{1/n}$. Hence the Theorem.

Let G be a graph with n vertices. $a_1, a_2 \dots\dots\dots a_n$ be its vertex labels. Any edge $\{v_i, v_j\}$ of G gets the label, $\left(\mu(v_i, v_j)\right)^{1/n} a_i{}^{1/n} a_j{}^{1/n}$. So when we calculate the Fuzzy Generalised Geometric mean with respect to G, each vertex v_i contribute $\left(\mu(v_i, v_j)\right)^{1/n} a_i{}^{1/n}$. Similarly, when we calculate the Fuzzy Generalised Geometric mean with respect to G', each vertex v_i contribute $([1-$

$\mu(v_i, v_j)]\ )^{1/n} a_i^{\ 1/n}$ Thus when we calculate the product $GGM(G).GGM(G')$ each vertex v_i contributes $(\mu(v_i, v_j)\ )^{1/n} a_i^{\ 1/n}.([1 - \mu(v_i, v_j)]\ )^{1/n} a_i^{\ 1/n}$. Hence the Theorem follows.

C. VE-Fuzzy Generalised Variance

Variance is defined as the arithmetic mean of the squares of the deviations of the observations from their arithmetic mean. The Square root of the variance is called the standard deviation.

1) *Definition.* Let $a_1, a_2, \ldots \ldots \ldots a_n$ be a given set of numbers with mean μ. Let G be any Fuzzy graph with n vertices $v_1, v_2 \ldots \ldots v_n$ and assign the vertex label $\overline{v_i} = (a_i\sigma(v_i) - \mu)^2$ to each vertex v_i of G. For any edge $\{v_i, v_j\}$ of G assign the label $\mu(v_i, v_j)\,(\overline{v_i} + \overline{v_j})/n$. Then VE-Fuzzy Generalised Variance (FGV) is defined as the sum of all edge labels of G. Square-root of the VE-Fuzzy Generalised variance is called the VE-Fuzzy Generalised Standard Deviation (VEFGSD).
2) *Theorem.* For a graph G with vertex degrees, $d_1, d_2 \ldots \ldots .. d_n$ and for a set of numbers $a_1, a_2, \ldots \ldots \ldots a_n$ with mean μ. Then VE-Fuzzy Generalised variance is given by $\frac{1}{n}\sum_{i=1}^{n} d_i\overline{v_i}$, where $\overline{v_i} = (a_i\sigma(v_i) - \mu)^2$

a) *Proof:* We assign the label: $\mu(v_i, v_j)\,(\overline{v_i} + \overline{v_j})/n$ to any edge, $\{a_i, a_j\}$. So, if we count the sum of the edge labels of G, then, each vertex v_i with degree d_i contributes $d_i(\overline{v_i} + \overline{v_j})/n$ to the sum of the edge labels of all edges of the graph. Hence, VE-Fuzzy Generalised variance is $\frac{1}{n}\sum_{i=1}^{n} d_i\overline{v_i}$, where $\overline{v_i} = (a_i\sigma(v_i) - \mu)^2$.

3) *Corollary.* For a 1-Regular graph, VE-Fuzzy Generalised Standard deviation (VEFGSD) is same as the usual Standard deviation of given set of numbers. For a 2- regular graph, VEFGSD is same as $\sqrt{2}$ times the usual Standard deviation of given set of numbers.

D. Fuzzy Generalised Covariance

Covariance is a statistical measure used in the Correlation analysis to explore the "Linear" relationship among the data. VE-Fuzzy Generalised Covariance (VEFGCOV) gives an approach to the Non-linear Combinatorial relationship among the data, through Fuzzy graph models. In this section, we introduce the notion of the VE-Fuzzy Generalised Covariance to give an approach of Non-linear, Fuzzy, Combinatorial relationship among the data, through Fuzzy graph models.

1) *Definition.* Let $\{(x_i, y_i)\}_{i=1,2,\ldots n}$ be a given data. Let G be a Fuzzy graph with n vertices, $\{v_i\}, i = 1,2, \ldots n$. Assign (x_i, y_i) to each vertex v_i of G. Let a, b are the means of $x_i's$ and y_i's respectively. To each edge $\{v_i, v_j\}$ of the Fuzzy graph G, assign the label $\mu(v_i, v_j)\,(\overline{v_i} + \overline{v_j})/n$ where $\overline{v_i} = \sigma(v_i)(x_i - a)(y_i - b)$. Then VE-Fuzzy Generalised Covariance is sum of the edge labels of G.
2) *Theorem.* Let $\{(x_i, y_i)\}_{i=1,2,\ldots n}$ be a given data and G be a Fuzzy graph with vertex degrees, $d_1, d_2 \ldots \ldots .. d_n$, Then VE-Fuzzy Generalised Covariance is given by $\frac{1}{n}\sum_{i=1}^{n} d_i\overline{v_i}$, where $\overline{v_i} = \sigma(v_i)\,(x_i - a)(y_i - b)$.

a) *Proof:* For any edge $\{a_i, a_j\}$ assign the label: $\mu(v_i, v_j)(\overline{v_i} + \overline{v_j})/n$ where $\overline{v_i} = (x_i - a)(y_i - b)$ and $\overline{v_j} = \sigma(v_i)\,(x_j - a)(y_j - b)$.Hence, if we count the sum of all the edge labels of G, then each vertex v_i with degree d_i contribute $d_i\overline{v_i}/n$ to the sum of the edge labels of all edges of the graph. Hence the Fuzzy Generalised Covariance is given by $\sum_{i=1}^{n} \overline{v_i}d_i/n$.

The following is a useful bound for VE-Fuzzy Generalised Covariance of a given data.

3) *Corollary.* For a 1-Regular graph, VE-Fuzzy Generalised Covariance (VEFGCOV) of a data is same as the usual Covariance of given set of numbers. For a 2- regular graph, VEFGSD is same as $\sqrt{2}$ times the usual Covariance of given set of numbers. For a k- regular graph, VEFGSD is same as $\sqrt{k}$ times the usual Covariance of given set of numbers.
4) *Corollary.* For a Fuzzy graph G with n vertices, $COV \leq VEFGCOV(G) \leq (n-1)COV$Now, we proceed to investigate the Nordhaus-Gaddum type result for the graph parameter, the Fuzzy Generalised Covariance. Let G be a Fuzzy graph with vertex degrees, $d_1, d_2 \ldots \ldots .. d_n$ so that G' is the graph with vertex degrees, $n-1-d_1, n-1-d_2 \ldots \ldots .. n-1-d_n$. Then VE-Fuzzy Generalised Covariance of a data with respect to G satisfies Nordhaus-Gaddum bounds as below.
5) *Theorem.* For a Fuzzy graph G, $VEFGCOV(G) + VEFGCOV(G') = (n-1)COV$

a) *Proof:* Let G be a Fuzzy graph with n vertices and $a_1, a_2 \ldots \ldots . a_n$ be its vertex labels. Any edge $\{v_i, v_j\}$ of G gets the label $(\overline{v_i} + \overline{v_j})/n$ where $\overline{v_i} = \sigma(v_i)\,(x_i - a)(y_i - b)$. Thus when we calculate the VE-Generalised Covariance with respect to G,

each vertex v_i contribute $\bar{v}_i/n$ to each edge to which it is incident with. Thus each vertex v_i contributes $(n-1)\,\bar{v}_i/n$ to the sum $VEFGCOV(G) + VEFGCOV(G')$. Hence the Theorem.

E. Generalised Correlation Coefficient

The Correlation Coefficient quantifies the strength of the linear relationship between two variables in the correlation analysis. The Correlation Coefficient is defined by

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \sum(y_i - \bar{y})^2}}$$

1) *Definition.* Let $\{(x_i, y_i)\}_{i=1,2,\ldots n}$ be the given data. Let $G = (V, \sigma, \mu)$, be a Fuzzy graph with n vertices. Assign (x_i, y_i) to each vertex v_i of G. Let $X = \{x_i\}_{i=1,2,\ldots n}$ and $Y = \{y_i\}_{i=1,2,\ldots n}$. Then

$$VE \text{ Fuzzy Generalised Correlation coefficiant } = \frac{\text{VE Fuzzy } Generalsed\ Covariance\ of\ G}{(VEFGSD\ of\ X)(VEFGSD\ of\ Y)}$$

2) *Theorem.* For all regular Fuzzy graphs with n vertices, the VE-Fuzzy Generalised Correlation coefficient is same as the usual Correlation coefficient.

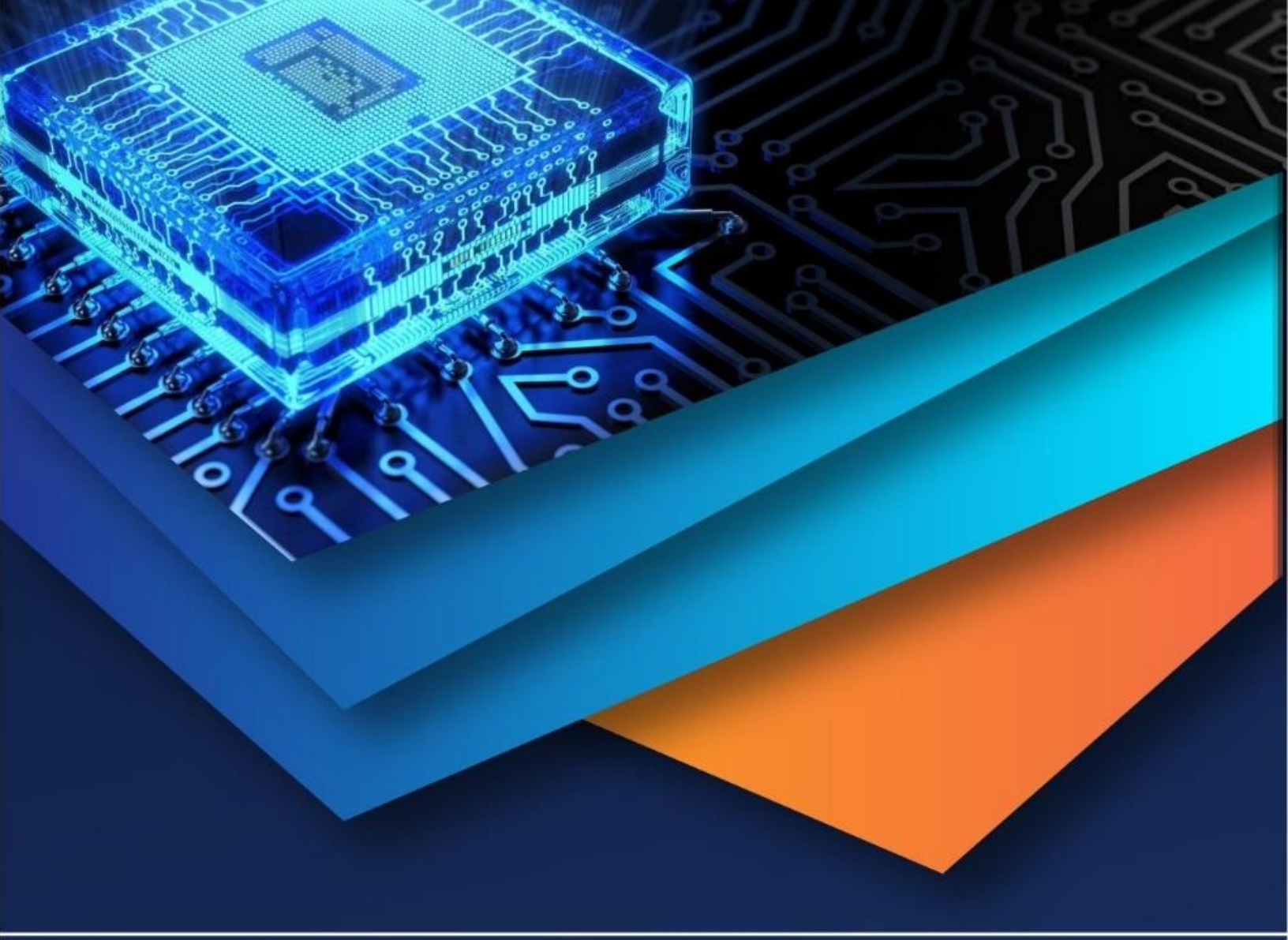
a) *Proof:* Let G be a k-regular Fuzzy graph with n vertices and assign (x_i, y_i) to each vertex v_i of G. Since G is k −regular, $VEGCOV(G) = k(COV)$, $VEFGSD(X) = \sqrt{k}\,SD(X)$ and $VEFGSD(Y) = \sqrt{k}\,SD(Y)$. Hence, the VE-Fuzzy Generalised Correlation coefficient is:

$$\frac{\text{VE Fuzzy } Generalsed\ Covariance\ of\ G}{(VEFGSD\ of\ X)(VEFGSD\ of\ Y)} = \frac{k.Covariance\ of\ G}{(\sqrt{k}.\,SD\ of\ X)(\sqrt{k}\,SD\ of\ Y)}$$

Which is the usual Correlation coefficient and the theorem follows.

REFERENCES

[1] Suresh Kumar J, Graph Algorithms and Abstraction for Number Theoretic Concepts, International Journal of Mathematics and its Applications (IJMAA), 7(2) (2019), 39-41.
[2] Suresh Kumar J, and Sarika M Nair, Generalized Mean and Variance, International Journal for Research in Applied Science & Engineering Technology (IJRASET), March, 2020.
[3] Suresh Kumar J, and Sunil M.P., On Fuzzy Distance in Fuzzy Graphs, International Journal of Mathematics and its Applications (IJMAA), 8(1)(2020), 89-93.
[4] Suresh Kumar J, and Sunil M.P., On Sum-Distance in Fuzzy Graphs, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 8 Issue I, Jan 2020.
[5] Suresh Kumar J, and Sunil M.P., Fuzzy Generalised Mean and Variance, Submitted to: International Journal of Mathematics and its Applications (IJMAA), March, 2020 (Pre Print).
[6] V. K. Rohatgi, AK Md. Ehsanes Saleh, An Introduction to Probability and Statistics, John Wiley and Sons, 2011.
[7] Harary Frank, Graph Theory, Reading Mass, 1969.



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