iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** II **Month of publication:** February 2022

DOI: https://doi.org/10.22214/ijraset.2022.40273

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue II Feb 2022- Available at www.ijraset.com

Characteristics of Fuzzy Petersen Graph and Platonic Graph with Fuzzy Rule

Suguna. R[1], Naveen. L[2]
[1]*MSc Mathematics,* [2]*Assistant Professor, Department Of Mathematics, Dr. SNS Rajalakshmi College Of Arts And Science (Autonomous), Coimbatore, Tamil Nadu, India*

Abstract: ***Graph theory is the concepts used to study and model various application in different areas. In this paper, we consider the The Petersen and also the Platonic graph using if-then-rules fuzzy numbers. The results are related to the find the degree of odd vertices and even verticesare same by applying if-then-rules through the paths described by fuzzy numbers.***
Keywords: Degree of Vetex, Incident Graph, Peterson Graph, Platonic graph, Fuzzy IF-THEN rule.

I. INTRODUCTION

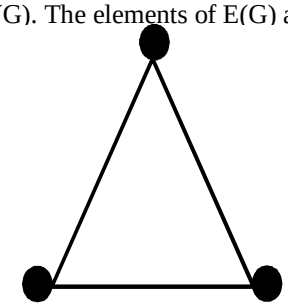
The first definition of fuzzy graph was introduced by Kaufmann (1973), based on Zadeh's fuzzy relations (1971) A more elaborate definition is due to Azriel Rosenfeld who considered fuzzy relation on fuzzy sets and developed the theory of fuzzy graph in 1975. During the same time Yeh and Bang have also introduced various connectedness concepts in fuzzy graph. Till now fuzzy graphs has been witnessing a tremendous growth and finds applications in many branches of engineering and technology.

Fuzzy systems based on fuzzy if-then rules have been successfully applied to variousthеorems in the field of fuzzy control. Fuzzy Rule based system has high comprehensibility because human users can easily understand the meaning of each fuzzy if-then rule through its linguistic interpretation. Graph theory has numerous applications to problems in system analysis, operation research, transportation and economics. In many cases, however some aspects of graph theoretic problem may be uncertain. For example, the vehicle travel time or vehicle capacity on a road network may not be known exactly. In such cases, it is natural to deal with the uncertainly using fuzzy set theory. The concepts of a fuzzy graph are a natural generalization of crisp graphs, given by Rosenfeld [Zadeh et al., 1975] .

II. BASIC CONCEPT

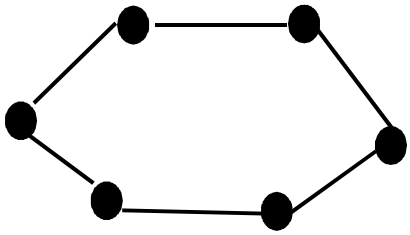
A. Definition 2.1

A graph G consists of a pair G: (V,E) 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.



B. Definition 2.2: Cycle Graph

In graph theory, a cycle graph or circular graph is a graph that consists of a single cycle, or in other words, some number of vertices (at least 3)connected in a closed chain. The cycle graph with n vertices is calledc_n. The number of vertices in$c_n$equals the number of edges, and every vertex has degree 2; that is, every vertex has exactly two edges incident with it.

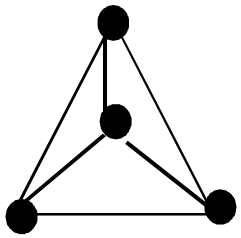


©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue II Feb 2022- Available at www.ijraset.com

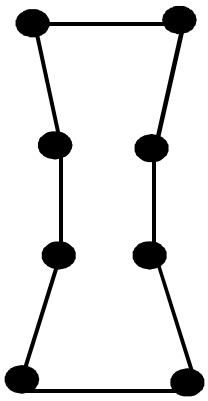
C. Definition 2.3

A wheel graph is obtained from a cycle graph C_{n-1} by adding a new vertex. That new vertex is called a Hub which is connected to all the vertices of C_n.



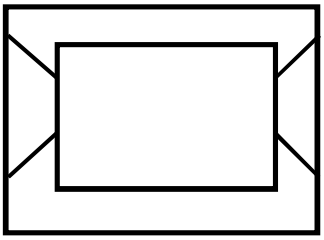
D. Definition 2.4: Hamilton Cycle

A path that contains every vertex of G is called a Hamilton path of G. similarly a Hamilton cycle of G is a cycle that contains every vertex of G



E. Definition 2.5: Hamilton graph

A graph Hamiltonian if it contains a Hamilton cycle is called Hamilton graph.



F. Definition 2.6

Let V be a non- empty set. A fuzzy graph is a pair of function G :(σ, μ), where σ is a fuzzy subset of V and μ is a symmetric fuzzy relation on σ. i.e.,σ:V→ [0,1] such that μ(u,v)≤ $\sigma(u)$^$\sigma(v)$ for all u, v in V. where , uv denotes the edge between u and v and $\sigma(u)$^$\sigma(v)$ denotes the minimum of $\sigma(u) and\ \sigma(v)$.

G. Definition 2.7: Incident

When a vertex $\sigma(u_i)$ is an end vertex of some edges μ(u_i, v_j) of any fuzzy graph G:(σ,μ).Then $\sigma(u_i)$ and μ(u_i, v_j) are said to be incident to each other.

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue II Feb 2022- Available at www.ijraset.com

H. Definition 2.8

The degree of anyvertex$\sigma(u_i)$ of a fuzzy graph is sum of degree of membership of all those edges which are incident on vertex $\sigma(u_i)$ and is denoted by d[$\sigma(u_i)$].

I. Definition 2.9: Fuzzy If-Then Rule

A fuzzy rule is defined as a conditionalStatement in the form:

IF x is A,THEN y is B; where x and y are linguisticvariable; A and B are linguistic values determined by fuzzysets on the universe of discourse XandY, respectively.

1) A rule is also called a fuzzy implication.

2) "x is A" is called the antecedent or premise.

3) "y is B" is called the consequenceor conclusion.

Example:

- IF pressure is high, THEN volume is small.
- IF the speed is high, THEN apply the brake a little.

III. FUZZY PETERSEN GRAPH WITH FUZZY RULE

1) Theorem

In fuzzy Petersen graph G, the sum of degrees of vertices of even degree is equal to twice the degree of membership of all the edges and the difference of the sum of degrees of vertices of odd degree.

Proof: LetG:(σ,μ) is fuzzy Petersen graph. Consider 10-vertices { $\sigma(v_1), \sigma(v_2), \sigma(v_3), \sigma(4), \ldots \sigma(10)$} of fuzzy petersenl graph G:(σ,μ)

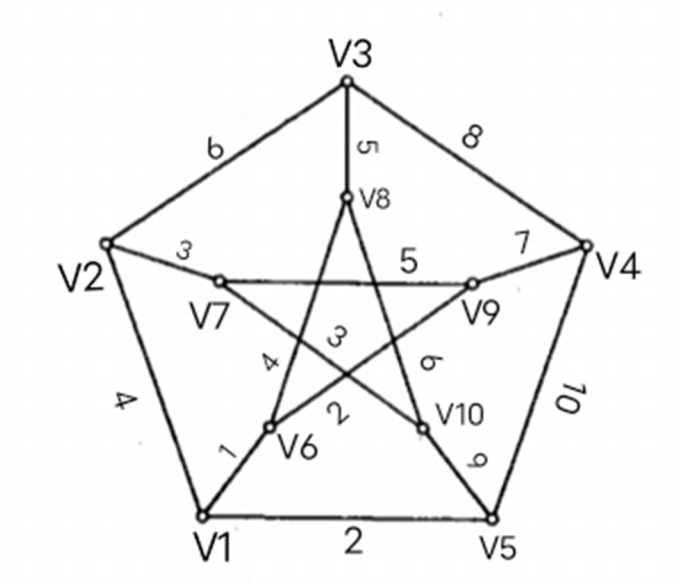


Figure: Peterson graph

IF the membership grades of edges which are incident on any degree of vertexσ( ) are added, THEN the sum of corresponding membership value of vary.

d[$\sigma(v_1)$] = 2 + 4 + 1 = 7
d[$\sigma(v_2)$] = 4 + 6 + 3 = 13
d[$\sigma(v_3)$] = 6 + 8 + 5 = 19
d[$\sigma(v_4)$] = 8 + 10 + 7 =25
d[$\sigma(v_5)$] = 10 + 2 + 9 = 21
d[$\sigma(v_6)$] = 1 + 2 + 4 = 7
d[$\sigma(v_7)$] = 3 + 3 + 5 = 11

©IJRASET: All Rights are Reserved

$d[\sigma(v_8)]$ = 5 + 6 + 4 = 15
$d[\sigma(v_9)]$ = 7 + 5 + 2 = 14
$d[\sigma(v_{10})]$ = 9 + 3 + 6 = 18
IF the membership grades of edges are added, THEN we find the degree of edges,
$\sum_{i=1}^{11}\mu(u_i, v_{i+1})$=2+4+6+8+10+1+3+5+7+9+2+4+5+3+6=75
$\sum_{i=1}^{11}\mu(u_i, v_{i+1})$=75
$\sum_{i=1}^{11} d[\sigma(v_i)]$=Twice the sum of degree of membership of (u_i, v_{i+1})
Therefore,$\sum_{i=1}^{n} d(v_i)$=$2\sum_{i=1}^{n}\mu(u_i, v_{i+1})$
But here,
The deg$[\sigma(v_i)]$ has been splitied into two parts.
i.e.,$\sum_{i=1}^{k} deg(v_i)+\sum_{i=1}^{n} deg(w_k)=2\sum_{i=1}^{n}\mu(u_i, v_{i+1})$
$\sum_{i=1}^{k} d(v_i)$ denotes the sums over even degree vertices, i.e.,$\sigma(v_2)$, $\sigma(v_4)$, $\sigma(v_6)$, $\sigma(v_8)$, $\sigma(v_{10})$.
$\sum_{i=1}^{k} d(v_i)$=13+25+7+15+18
$\sum_{i=1}^{k} d(v_i)$=78
Now,$\sum_{i=1}^{n} d(w_k)$ denotes the sum over odd degree vertices, i.e., $\sigma(v_1)$, $\sigma(v_3)$, $\sigma(v_5)$, $\sigma(v_7)$, $\sigma(v_9)$
$\sum_{i=1}^{n} d(w_k)$=7+19+21+11+14
$\sum_{i=1}^{n} d(w_k)$=72
Hence If the sum of degrees of vertices of even degree is 72,then it is equal to twice the degree of membership of all edges and difference of the sum of degrees of vertices of odd degree**.**
$\sum_{i=1}^{k} d(v_i)$= $2\sum_{i=1}^{n}\mu(u_i, v_{i+1})$-$\sum_{i=1}^{n} d(w_k)$
72=2(75)-78
=150-78
72=72
Hence the theorem.

2) Theorem

In fuzzy Platonic graph G, the sum of degrees of vertices of even degree is equal to twice the degree of membership of all the edges and the difference of the sum of degrees of vertices of odd degree.

Proof: Let G:(σ,μ) is fuzzy Platonic graph. Consider 4-vertices { $\sigma(v_1), \sigma(v_2), \sigma(v_3), \sigma(v_4)$} of fuzzy platonic graph G:(σ,μ)

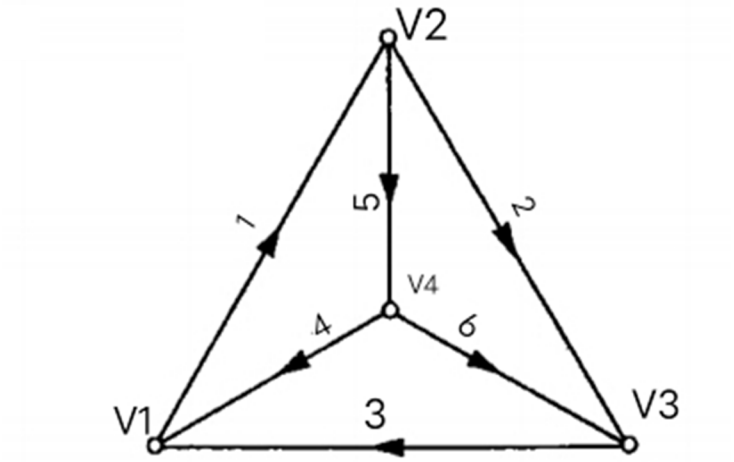


Figure: Fuzzy platonic graph

IF the membership grades of edges which are incident on any degree of vertex σ( ) are added, THEN the sum of corresponding membership value of vary.
$d[\sigma(v_1)]$ =3+1+4=8
$d[\sigma(v_2)]$ =1+5+2=8

d[$\sigma(v_3)$] =6+2+3=11
d[$\sigma(v_4)$] =4+6+5=15
IF the membership grades of edges are added, THEN we find the degree of edges,
$\sum_{i=1}^{6}\mu(u_i, v_{i+1})$=3+1+2+4+6+5=21
$\sum_{i=1}^{6}\mu(u_i, v_{i+1})$=21
$\sum_{i=1}^{6} d[\sigma(v_i)]$ =Twice the sum of degree of membership of (u_i, v_{i+1})
Therefore,$\sum_{i=1}^{n} d(v_i)$=2$\sum_{i=1}^{n}\mu(u_i, v_{i+1})$
But here,
The deg[$\sigma(v_i)$] has been splitied into two parts.
i.e.,$\sum_{i=1}^{k} deg(v_i)$+$\sum_{i=1}^{n} deg(w_k)$=2$\sum_{i=1}^{n}\mu(u_i, v_{i+1})$
$\sum_{i=1}^{k} d(v_i)$ denotes the sums over even degree vertices, i.e.,$\sigma(v_2)$, $\sigma(v_4)$.
$\sum_{i=1}^{k} d(v_i)$=8+15=23
$\sum_{i=1}^{k} d(v_i)$=23
Now,$\sum_{i=1}^{n} d(w_k)$ denotes the sum over odd degree vertices, i.e., $\sigma(v_1)$, $\sigma(v_3)$.
$\sum_{i=1}^{n} d(w_k)$=8+11=19
$\sum_{i=1}^{n} d(w_k)$=19
If the sum of degrees of vertices of even degree is 19, it is equal to twice the degree of membership of all edges and difference of the sum of degrees of vertices of odd degree**.**
$\sum_{i=1}^{k} d(v_i)$= 2$\sum_{i=1}^{n}\mu(u_i, v_{i+1})$-$\sum_{i=1}^{n} d(w_k)$
23=2(21)-19
23=23
Hence the theorem.

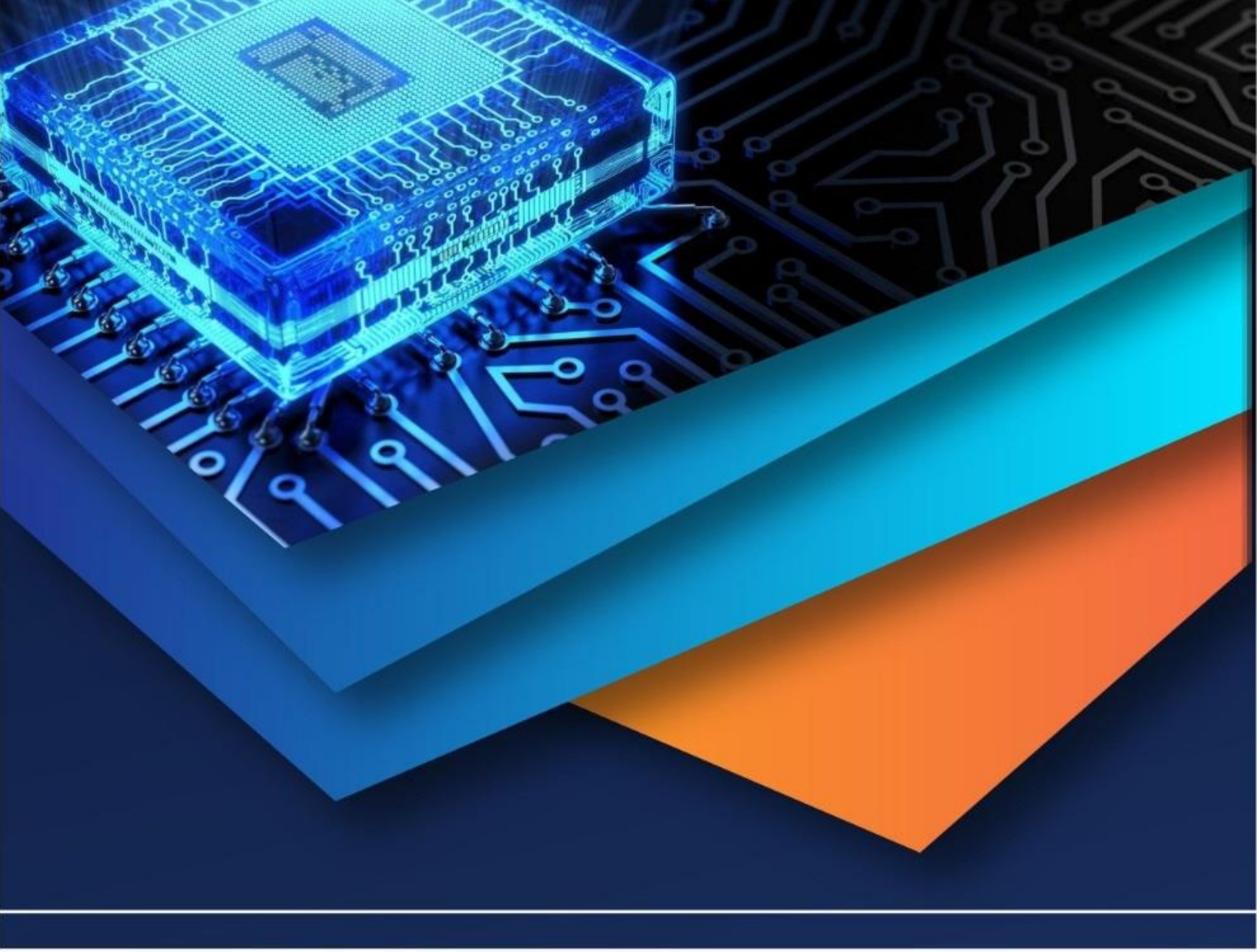
IV. CONCLUSION

In this paper we obtain that petersen graph and platonic graph . We conclude that the odd degree of vertices is equal to the even degree of vertices, for both the above cases with the help of IF-THEN rules (i.e., L.H.S=R.H.S).Finally, IF-THEN rules applied through shortest paths are shown with different analysis.

REFERENCES

[1] Dr.G.Nirmala,P.Sindhamani “Characteristics of fuzzy Petersen graph with fuzzy rule”,journal,2014.
[2] Dr.Dr.G.Nirmala,S.Prabavathi “Application of fuzzy if-then rule in Peterson graph”, volume 4,issue 8,August 2014.
[3] M.Tamilarasi,Dr.S.S.Dhenakaran “Hamiltonian Approach for shortest path”,IJSRT 184894 June 2018.
[4] Sunny Dagar,”Modified prim’s Algorithm” volume 03, volume 02,2012.
[5] Dr.DVijayalakshmi,R.Kalaivani “Minimum cost spanning tree using matrix algorithm “Journal.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)