ISSN (e): 2250 – 3005 || Volume, 08 || Issue, 5|| May – 2018 ||

International Journal of Computational Engineering Research (IJCER)

Strong and Weak Cubic Fuzzy Planar Graph

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ABSTRACT

In this paper we defined the concept of fuzzy planar graph. Fuzzy Planar graph is a very important one in fuzzy graph. We discussed strong fuzzy planar graph and various properties are presented . Finally some related results are established in cubic fuzzy planar graph.

KEYWORDS : Fuzzy graph, Fuzzy Planar graph, fuzzy faces, cubic fuzzy graph.

Date of Submission: 28-04-2018 Date of acceptance: 14-05-2018

I INTRODUCTION

Planarity by is important in connecting the wire lines, gas lines, waterlines, etc . But some lines little crossing may be accepted to these design of such lines or circuit. So fuzzy planar graph is an important topic in fuzzy graphic. They are many practical applications with a graph structure in which crossing between two connections normally means that the communications lines must be run at different heights. These applications are designed by concept of planar graphs circuits where crossing of lines is necessary cannot be represented by planar graphs.

Abdul- Jabbar, J.H. Noom and E.H. Ouda introduced the concepts of fuzzy planar graph. G.Nirmala and K.Dhanabal defined special fuzzy planar graphs and also Sovan Samanta, Anitapal, and Madhumangal Pal defined fuzzy planar graph in a different concepts where crossing of edges are allowed. We also different lot of results are presented for these graphs.

II PRELIMINARIES

Definition 2.1 (Fuzzy Graph)

A fuzzy graph G (σ,μ) is a pair of function $\sigma : V \to [0,1]$ and μ : vxv $\to$ [0,1] such that σ (u,v) $\leq$ σ (u) $\wedge$ σ (v) for all u,v in V

Example 2.1

A fuzzy graph G= (σ,μ) Where σ = {u/.5,v/.4,w/.6}
and μ = {u,v/.3 , u,w/.4, v,w/.2}

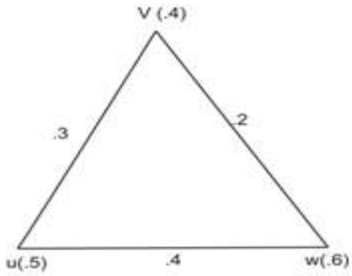

Figure 1

<u>Definition 2.2 (Planar graph)</u>

A graph G is said to be planar if there exists some Geometric representation of G which can be drawn on plane such that no two of its edges intersect.

Example 2.2 :

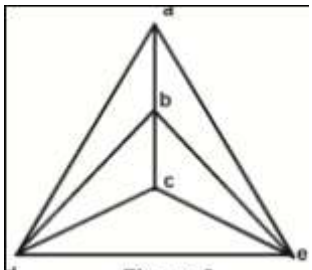

Figure 2

Definition 2.3 (Non Planar graph)

If graph G is said to be non planar if there exists some Geometric representation of G which cannot be drawn on plane such that two of its edges intersect.

Example 2.3 :

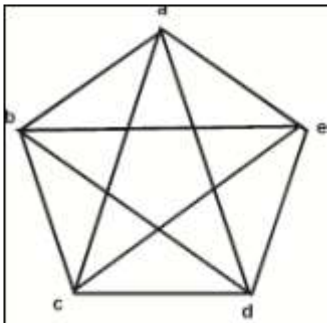

Figure 3

Definition 2.4 (Planar fuzzy graph)

If a fuzzy graph G can be drawn on a plane such that no two of its edges intersect than G is said to be planar fuzzy graph.

Example 2.4 :

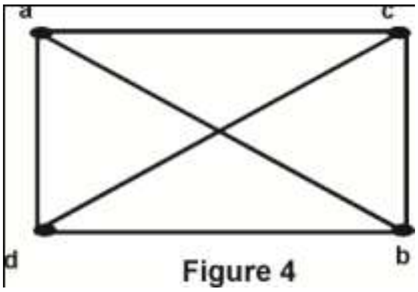

Figure 4

Definition 2.5 (Planar cubic graph)

If planar it can be drawn in the plane without crossing and cubic if the degree of all the three vertices is three.

Definition 2.6 (Cubic fuzzy graph)

A Cubic fuzzy graph is three regular fuzzy graph. (i.e) Fuzzy graph whose vertices all have degree 3.

Example 2.5

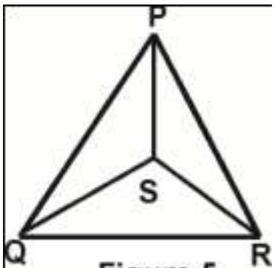

Figure 5

Definition 2.7 (planar embedding)

A drawing of a Geometric representation of a graph on any surface such that no edges intersect is called embedding.

Example 2.6

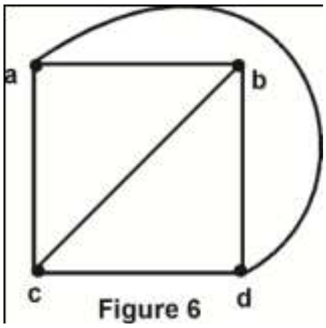

Figure 6

Definition 2.8 (Strong and Weak edge)

The fuzzy graph G = (v, σ, μ) an edge (x, y) is called strong if $\frac{1}{2}\min\{\sigma(x) \wedge \sigma(y)\} \le \mu(x,y)$ and weak other wise.

Definition 2.9 (effective edges)

If an edge (x, y) of a fuzzy graph satisfies the condition

$\mu(x,y) = \min\{\sigma(x) \wedge \sigma(y)\}$ then this edge is called effective edge.

Definition 2.10 (Strong and Weak fuzzy planar graphs)

A fuzzy planar graph U is called Strong fuzzy planar graph if the fuzzy planaring value of the graph is greater than 0.5

If the weak fuzzy planar graph, as its planaring value is less than 0.5.

III MAIN RESULT

- Let G be a fuzzy planar graph with planarity value f where

$f = \frac{1}{1+IP1+IP2+\cdots\ldots\ldots IPn}$

the range of f is $0 < f \le 1$. Here $P_1, P_2, \ldots Pn$ be the Point of Intersection.

- In a graph G = (v, σ, E) contains two edges $\mu(a,b)$ *and* $\mu(c,d)$ which are intersected at a point P

Strength of fuzzy edge I (a, b) = $\frac{\mu(a,b)}{\sigma(a) \wedge \sigma(b)}$

The intersecting Point P is $I_P = \frac{I(a,b) + I(c,d)}{2}$

- If there is no point of intersection for a Geometrical representation of a fuzzy graph than its fuzzy planarity value is 1.
- If μ (w,x) = 1 (or near to 1) and μ (y,z) = 0 (or near to 0) then we say that the fuzzy graph has no crossing . Then the crossing will not be important for planarity similarly μ (w,x) = 1 and μ (y,z) = 1 then the crossing will be important for planarity.
- Strong fuzzy planar if f is greater than or equal 0.5 otherwise weak.

Theorem 3.1 :

Let ψ be a strong fuzzy planar graph. The Number of point of Intersection between strong edges in ψ is at most one.

Proof :

Let $\psi = (v, \sigma, \mu)$ be a strong fuzzy planar graph. Let it possible ψ has at least two point of Intersection P_1 and P_2 between two strong edges in ψ

For any strong edge { (a, b) (a, b) μ^J } (a, b) $\mu^J \ge \frac{1}{2}\min\{\sigma(a)\, \sigma(b)\}$

so $I(a,b) \ge 0.5$

Thus for two intersecting strong edges { (a, b) (a, b) μ^J } and { c, d) (c, d) μ^J}

$\frac{I(a,b) + I(c,d)}{2} \ge 0.5$ (i.e) $IP_1 \ge 0.5$ $IP_2 \ge 0.5$

Then $1 + IP_1 + IP_2 \ge 2$ There fore $f = \frac{1}{1+IP1+IP2} \le 0.5$. If contradict the fact that the fuzzy graph is strong fuzzy planar graph. So the number of Point of intersect between strong edges cannot be two. It is clear that number of part of intersect of strong fuzzy edges increases the fuzzy planarity value decreases. Any fuzzy planar graph without any crossing between edges is a strong fuzzy planar graph. So we conclude that the maximum number of point of intersection between the strong edges in ψ is one.

Example 2.7

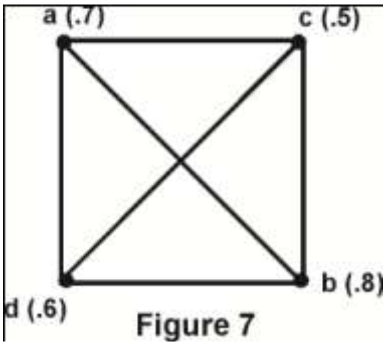

Figure 7

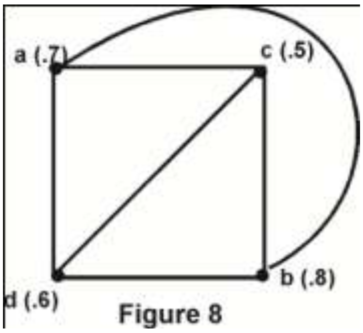

Figure 8

Consider the Cubic fuzzy graph two edges (a, b) and (c, d) are intersected.
Where $\sigma(a) = 0.7$ $\sigma(b) = 0.8$ $\sigma(c) = 0.5$ $\sigma(d) = 0.6$
$\sigma(a,b) = 0.6$ $\sigma(c,d) = 0.4$

Strength of the edge (a,b) is $= \frac{0.6}{0.7} = 0.85$

(c, d) is $= \frac{0.4}{0.5} = 0.8$

Intersecting Value $= \frac{0.85+0.8}{2} = 0.825$

If the number of point of Intersection Strong edges is one then the fuzzy planarity value $f > 0.5$ any fuzzy planar graph without any crossing between edge is a strong fuzzy planar graph. The Maximum number of point of Intersection between the Strong edges 1 in ψ is one.

Example 2.8

Let us consider two cubic fuzzy planar graphs with one crossing between effective edges (a,d) (b,e). Let $\sigma(a) = \sigma(b) = \sigma(c) = \sigma(d) = \sigma(e) = 1$
μ (a, d) = 0.9 $\mu(b, e) = 0.7$. Therefore for this fuzzy planar graph f $>$ 0.5 number of point of Intersection is one.

Let us consider with two crossing between effective edges (a, d) (b, e) and
(a, d) (c, e) . Let $\sigma(a) = \sigma(b) = \sigma(c) = \sigma(d) = \sigma(e) = 1$ (a, d)
$\mu^1 = 0.5$ (b, e) $\mu^1 = 0.5$ (a, d) $\mu^2 = 0.2$ (c, e) $\mu^1 = 0.5$.
There fore thus fuzzy planar graph f ≤ 0.5 . This is observation and above examples satisfied the statement of the theorem.

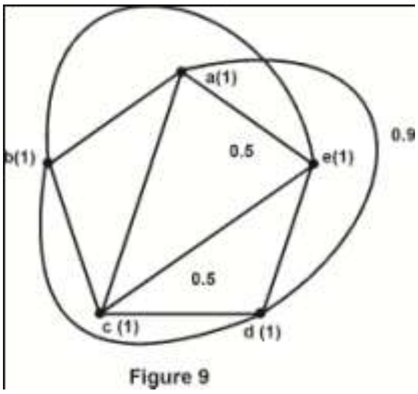

Figure 9

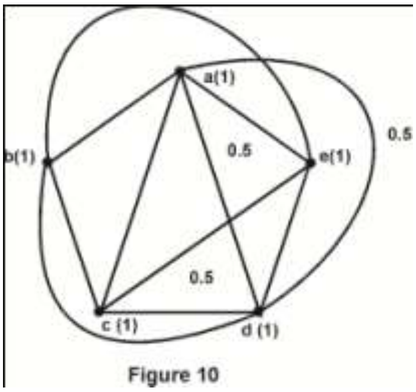

Figure 10

Definition 2.11 (Strong and Weak fuzzy face)

Let ψ = ((v, σ, E) be a fuzzy planer graph and E = { (x, y) (x, y) μ^J }
$J = 1, 2$ ……………………………. P_{xy} / (x, y) $\in$ V X V }
$P_{xy = \max \{ j / (x, y) \mu_j}$ $\neq 0$ } A fuzzy face of ψ is a region bonded by the set of fuzzy edges E^1
CE of a Geometric fuzzy face is min { $\frac{(x,y)\mu\ j}{\min(\sigma(x),\ \sigma(y)}$
j= 1,2.............P xy (x, y) $\in E^1$}

A fuzzy face is called strong fuzzy face if its membership value is greater than 0.5 and weak face otherwise. Every fuzzy planer graph has an infinite region which is called outer fuzzy faces are called inner fuzzy faces.

Example :2.9

Let F_1 , F_2 , F_3 three fuzzy faces F_1 is bounded by the edges((V_1, V_2) 0.5) ,

((V_2, V_3), 0.6) ((V_1, V_3) 0.5) with membership value 0.8 similarly F_2 is bounded face, F_3 is outer fuzzy face with membership value 0.3 . So F_1 is a strong fuzzy space F_2 , F_3 are weak fuzzy faces.

Every strong fuzzy face has membership value greater than 0.5 . So, every edge of a strong fuzzy face is a strong fuzzy edge.

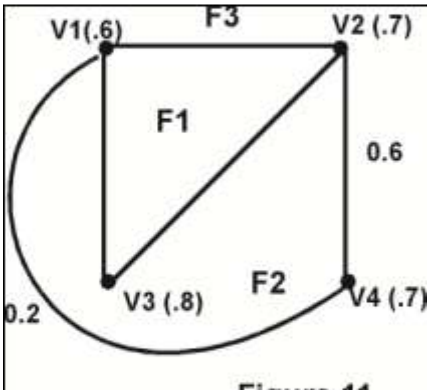

Figure 11

IV CONCLUSION

In this paper we defined the concepts of fuzzy planar graph next we finding strength of an edge, strong and weak fuzzy planar, planarity value, faces are presented .

Also the relation between fuzzy planar graph with the planarity and strong and weak of Cubic fuzzy Planar graph.

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M.Vijaya . "Strong and Weak Cubic Fuzzy Planar Graph." International Journal of Computational Engineering Research (IJCER), vol. 08, no. 05, 2018, pp. 53-57.