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On the Folding of Finite Generalized Fuzzy Topological Space by Directed Fuzzy Graph

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***Abstract:*-- The advancement in telecommunication and electronics results in enormous amount of data. The data or information collected from applications like traffic monitoring, weather monitoring, social networks (Facebook, Twitter, etc.,), web based retail applications (Amazon, Flipkart, etc..) are continuous data streams which cannot be handled by traditional data management systems. Data Stream Managers (DSM) IS used to handle the data with high volume and velocity, also known as Big Data. DSM helps to analyze the data streams to obtain useful insight from it. Streaming data are continuous in nature and it has to processed consecutively ensure the freshness of the data. The data transmitted via a network also consists of some sensitive information like patients health records, banking transactions, etc.. Since the analytics are used for decision making the data are transmitted has to be preserved from internal and external malicious attacks. In this paper, various data stream management and stream security models have discussed along with the symmetric cypher algorithms to implement the security models.**

Keywords – Folding, Finite Generalized Fuzzy Topological, and Directed fuzzy graph.

1. INTRODUCTION

Let X be a nonempty set and $\mathcal{F}$ = $\{\lambda|\lambda$:X → [0, 1]}be the family of all fuzzy sets defined on X. Let $\gamma: \mathcal{F} \to \mathcal{F}$ be a function such that λ≤μ implies that γ (λ) ≤ γ (μ) for every λ,μ$\epsilon\mathcal{F}$.That is, each γ is a monotonic function defined on $\mathcal{F}$.We will denote the collection of all monotonic functions defined on $\mathcal{F}$ by $\Gamma(\mathcal{F})$ or simply Γ.Let $\gamma\epsilon\Gamma$.A fuzzy set λ$\epsilon\mathcal{F}$ is said to be a γ-fuzzy open [3] if$\lambda \leq \gamma(\lambda)$. Clearly,$\bar{0}$, the null fuzzy set is γ-fuzzy open. In [3], it is established that the arbitrary union of γ-fuzzy open sets is again a γ-fuzzy open sets. A subfamily $\mathcal{G}$ of $\mathcal{F}$ is called a generalized fuzzy topology (GFT) [3].If $\bar{0}\epsilon\mathcal{G}$ and V $\{\lambda_\alpha|\alpha\epsilon\Delta\}\epsilon\mathcal{G}$ whenever $\lambda_\alpha\epsilon\ \mathcal{G}$ for every $\alpha\epsilon\Delta$. If $\gamma\epsilon\Gamma$, it follows that $\mathcal{A}$, the family of all of γ-fuzzy open sets is a generalized fuzzy topology.A fuzzy point [4] x_α, with support $x \in X$ and value 0< $\alpha \leq 1$ is defined by $x_\alpha(y) = \alpha$ if $y = x$ and $x_\alpha(y)$ =0, if $y \neq x$. Again, for $\lambda\epsilon\mathcal{F}$, we say that $x_0 \in \lambda$ if $\alpha \leq \lambda(x)$. Two fuzzy sets λ and β are said to be quasi-coincident [4], denoted by $\lambda q\beta$, if there exists $x\epsilon X$ such that $\lambda(x) + \beta(x) > 1$ [4]. Two fuzzy sets λ and β are not quasi-coincident denoted by $\lambda\bar{q}\beta$, if $\lambda(x) + \beta(x) \leq 1$ for all $x\epsilon X$. Clearly, λ is a γ-fuzzy open set containing a point x_α if and only if $x_0 q\lambda$, and $\lambda \leq \beta$ iff and only if $\lambda\bar{q}(\bar{1} - \beta)$. For definition not given here, refer [2]

FINITE GENERALIZED FUZZY TOPOLOGY AND DIRECTED FUZZY GRAPH:

Let X be a set of order n, i.e. |X| = n. Then we have the following one-to-one correspondence which we will explain below :{ Generalized fuzzy Topologies on X} ↔ {relations on X that are reflexive and transitive}.

EXAMPLE 1:

Let X = {x_1,x_2,x_3,x_4} be a set with two generalized fuzzy topologies

μ_(f_1)={X, φ,{x_2},{x_1,x_2},{x_2,x_3,x_4}and μ_(f_2)={X, φ,{x_2},{x_1,x_2},{x_2,x_3},{x_2,x_3,x_4}. The fuzzy graphs, which represent these generalized fuzzy topologies are G_(f_1) and G_(f_2) respectively Figure (1.1).

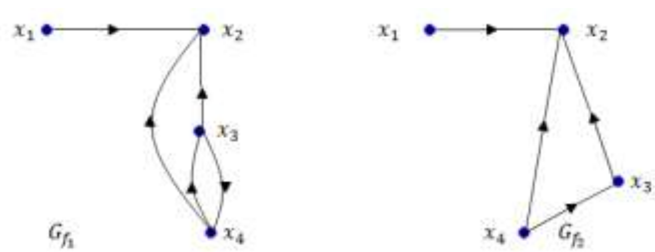

FIGURE – (1.1)

In the above example, since the generalized fuzzy topology μ_{f_2} is T_{f_0} generalized fuzzy topology on X, then the associated fuzzy graph G_{f_2} have not double arrows between any two points.

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FOLDING OF T_{f_0} GENERALIZED FUZZY TOPOLOGICAL SPACES:

In this section we discuss the folding of some T_{f_0} generalized fuzzy topologies defined on a finite set X.

CONDITION 1:

Let X be a finite T_{f_0} generalized fuzzy topological space of order n, such that $\bigcap_{i=1}^{n} A_i$= {a}, where $A_i \in \mu_f$.

THEOREM 1:

Let X be a finite T_{f_0} generalized fuzzy topological space satisfies condition 1 and has maximal transitive open set of order 3.The the folding f(X) is a T_{f_0} generalized fuzzy topological spaces and $|f(X)|$ = 3.

PROOF:

Let X be a finite T_{f_0} generalized fuzzy topological spaces, which satisfies condition 1 and has maximal transitive open set of order 3.

Then X can be represented fuzzy graphically by the following:

(1) Each maximal transitive open set {a,x_i, x_{i+1}} is represented by cycle C_{f_i}, i=1,3,………m

(2) Each open set {a,x_j} is represented by directed edge e_j , such that j ≠ i, j= m+1,….n.

Hence the fuzzy graph of the generalized fuzzy topological space X consists of directed edges e_j and cycles C_{f_i} or only by cycles C_{f_i} figure (1.2).

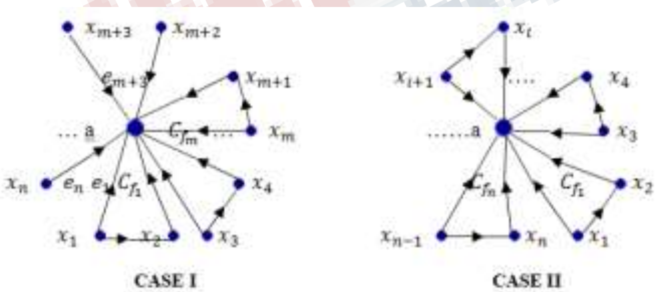

FIGURE – (1.2)

CASE I:

If the fuzzy graph consists of directed edges and cycles : In this case we can define a fuzzy graph folding as follows. Let $f_1{:}G_{f_1} \rightarrow G_{f_1}$ be a fuzzy graph a folding define as $f_1(a) = a$, $f_1(e_j) = e_n$, j = m+2,…..n, $f_1(C_i) = C_1$, i=1,……,m Figure – (1.3).

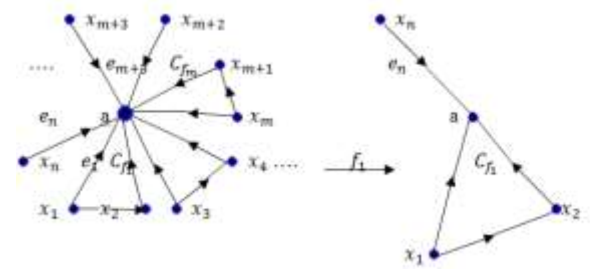

FIGURE – (1.3)

Note that $f_1(G_{f_1}) = G_{f_2}$ can be folded again as follows: Let $f_2{:}G_{f_2} \rightarrow G_{f_2}$ be a fuzzy graph folding define as $f_1(a) = a$, $f_1(e_n) = e_1$ Figure –(1. 4).

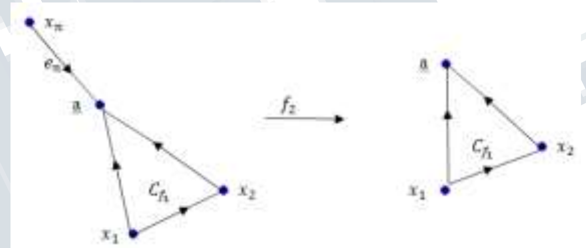

FIGURE- (1.4)

The complete fuzzy graph f(G_{f_2}) is represented a generalized fuzzy topology μ_f= {a,x_1, x_2},{a},{x_1,x_2},φ}.Which defined on the set $X^* = \{a, x_1, x_2\} \subset X$of order 3, and it is obviously this generalized fuzzy topology is T_{f_0} generalized fuzzy topology.

CASE II:

If the fuzzy graph consists of cycles. In this case we can define a fuzzy graph folding as follows. Let $\bar{f}{:}G_{f_1} \rightarrow G_{f_2}$ be a fuzzy graph folding define as $\bar{f_1}(a) = a$, $\bar{f}(C_i) = C_i$ i=1,2,3,4,…….,n Figure- (1. 5).

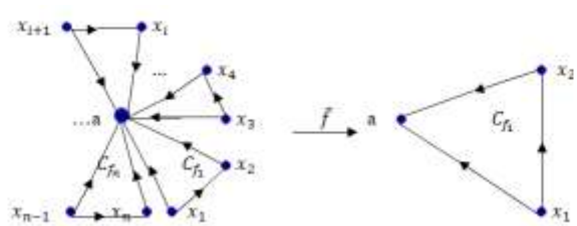

FIGURE – (1.5)

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The complete fuzzy graph $\bar{f}(G_{f_1}) = G_{f_2}$ represented a generalized fuzzy topology μ_f = {{a,x_1, x_2},{a},{x_1,x_2},φ} defined on the set $X^* = \{a, x_1, x_2\} \subset X$ of order 3, and it is obviously this is generalized fuzzy topology is also T_{f_0} generalized fuzzy topology.

EXAMPLE 2:
Let X = $\{x_1, x_2, x_3, x_4, x_5\}$ be a set with two generalized fuzzy topologies:
μ_{f_1}={X,φ,$\{x_1, x_2, x_3\}$,$\{x_4, x_3, x_5\}$,$\{x_3\}$,$\{x_1, x_2, x_3, x_4\}$,$\{x_2, x_3\}$,$\{x_2, x_3, x_5\}$,$\{x_3, x_5\}$
μ_{f_2}={X,φ,$\{x_3\}$,$\{x_4, x_3\}$,$\{x_3, x_5\}$,$\{x_1, x_2, x_3\}$,$\{x_4, x_3, x_5\}$,$\{x_2, x_3\}$,$\{x_4, x_2, x_3, x_5\}$,$\{x_2, x_3, x_4\}$,$\{x_2, x_3, x_5\}$,$\{x_1, x_2, x_3, x_4\}$,$\{x_1, x_2, x_3, x_5\}$,
It is obviously that the two generalized fuzzy topologies μ_{f_1}, μ_{f_2} are T_{f_0} generalized fuzzy topologies and satisfy condition 1.Then the directed fuzzy graphs representing these generalized fuzzy topologies are G_{f_1}, G_{f_2} respectively. In The generalized fuzzy topology μ_{f_1}. Let f_1:$G_{f_1} \to G_{f_2}$ be a fuzzy graph folding defined as follows:$f_1\{x_1, x_2, x_3, x_4, x_5\}$ = $\{x_1, x_2, x_3\}$ and ,$f_1(C_4) = C_1$.
Then $f_1\left(G_{f_1}\right)$ becomes a cycle which represented the generalized fuzzy topology $\mu_{f_1}^* = \{\{x_1, x_2, x_3\}, \ \phi, \{x_2, x_3\}, \{x_3\}\}$.
Also in the generalized fuzzy topology μ_{f_2}.Let f_2:$G_{f_2} \to G_{f_2}$ be a fuzzy graph folding defined as follows: $f_2\{x_1, x_2, x_3, x_4, x_5\} = \{x_1, x_2, x_3\}$ and ,$f_2(e_5, e_4) = e_1$.
Then $f_2(G_{f_2})$ become a cycle which represented the generalized fuzzy topology $\mu_{f_2}^* = \{\{x_1, x_2, x_3\}, \phi, \{x_2, x_3\}, \{x_3\}\}$ figure – (1.6).

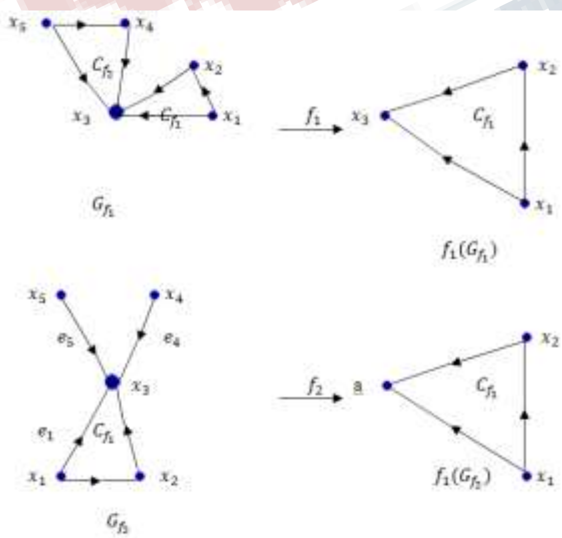

FIGURE – (1. 6)

THEOREM 2:
Let X be T_{f_0} generalized fuzzy topological spaces satisfying condition 1, and the maximal transitive open set is X. Then there is non trivial folding can be defined.

PROOF:
Since X is T_{f_0} generalized fuzzy topological spaces satisfying condition 1, and the maximal transitive open set is X. Then it is represented by complete directed fuzzy graph as follows, figure-(1. 7)

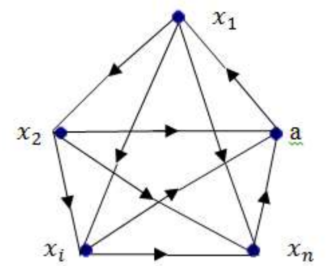

FIGURE – (1.7)

From [7] we cannot define a fuzzy graph folding for complete fuzzy graph hence, we cannot define a non trivial folding for X.

THEOREM 3:
Let X be T_{f_0} generalized fuzzy topological space satisfying condition 1 and has a maximal transitive open set of order 2. Then the folding of X is Sierpinski generalized fuzzy topological spaces.

PROOF:
Since X is T_{f_0} generalized fuzzy topological space satisfying condition 1, and has a maximal transitive open set of order 2. Then the fuzzy graph which represented this generalized fuzzy topological spaces is tree figure-(1. 8).

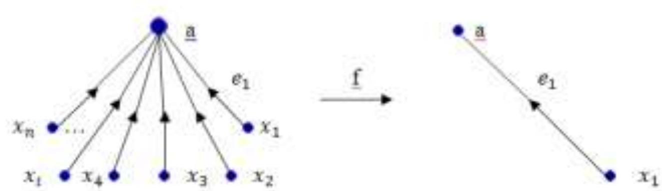

FIGURE – (1.8)

Then, we can define a fuzzy graph folding as follows:
let f: $G_f \to G_f$ be a fuzzy graph folding defined as f(a) = a, f(e_i) = e_1 , i= 1,3,….,n. Hence f (G_f) is a directed edge i.e. f(

$G_f) = e_1$ .Also the associated generalized fuzzy topology of e_1 is $\mu_f = \{\{a, x_1\}$ φ,{a}} defined on the set $X^* = \{a, x_1,\} \subset X$ and this generalized fuzzy topology is Sierpinski generalized fuzzy topology.

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