

Semantic Ordering Relation- Applied to Agatha Christie Crime Thrillers

T.Pathinathan, E.Mike Dison, K.Ponnivalavan
P.G. and Research Department of Mathematics, Loyola College, Chennai

Abstract - In any investigation, logical conclusions play a major part. In the present paper, we investigate the pattern which was widely used by Agatha Christie in her mystery novels and represent those literary elements by the relation called semantically ordering relation. The purpose of introducing this concept is to reduce the vagueness in naturally structured literary presentation by expressing the domain of linguistic variables into the fuzzy hedge based lattice structure. The idea proposed by Ho and Wechler has been applied in our analysis. Lastly, the paper compares the relation between the results obtained by the fuzzy based lattice structure with the projection and Max-Min composition principles.

Keywords: Hedge Algebra, Semantically ordering relation, Lattice structure, Distributive lattice structure, Max-Min principle, projection and Conceptual graphs

I. INTRODUCTION

Logic plays a vital role in deducing the conclusion as seen in mystery novels. We are of the opinion that understanding of major mathematical concepts may be motivated, explored and enhanced through literary art. Literature stirs our imaginations and emotions, making ideas more enjoyable and memorable. Literature involves short stories, poems, essays, novels and dramas. Serious study and discussions were attributed to many scholars and experts who got intrigued with mathematical concepts in literature. This line of thinking has been creating some interest to both those who already enjoyed mathematics and those who are yet to experience such a joy. Many authors use mathematics in stories, plays or poems in different ways. We use Agatha Christie crime thrillers to appreciate the fuzzy logic principles.

This paper meticulously analysis all the evidences, both oral and physical, as observed in Agatha Christie novels. In a mystery fiction, a detective either professional or amateur investigates and solves the puzzles. Crime fiction is the literary genre that fictionalises crimes, their detection, criminals and their motives. The term "mystery fiction" may sometimes be limited to the subset of detective stories in which the emphasis is on the puzzle/suspense element and its logical solution, in contrast to hardboiled detective stories, which focus on action and gritty realism.

In the mystery novels, Agatha Christie employs serious plot with many suspects (usually more than ten) and taut atmosphere. Each and every time the suspects involving in the plot come with distinct divergent elements and also make confusing statements. Thus it becomes very vague in finding out the culprit. For most of the time, the sentences that had been made by the suspects are in natural language. Natural

language mainly made up of the common linguistic variables and sometimes the linguistic variables are also used with some stress.

Most of the time, the suspects are humans, and the sentences made by them were too imprecise. Because of this imprecise data, it is very difficult to find the truth behind the mystery. In many occasions, the replies and answers given by the suspects during the investigations are listed out into some ordering relation. Though they are all sentences which belong to natural language, yet they allow an ordering relation between the motives and evidences exhibited by each and every suspect. Theoretical fuzzy logic explanation, principles like Projections and Max-min Compositions in finding the truth behind the mysteries have been applied [5]. Then the extension made by filtering the sentences using PRUF-CW language [5]. And also the paper examines the ordering relation modelled with conceptual graphs which was introduced by John F Sowa [7]. Sentences made by the suspects involve some ordering, which plays an important role in framing the pattern which in turn helps to find the truth behind the mystery.

II. PRINCIPLES USED

2.1 Euphemism

A euphemism is a generally innocuous word or expression used in place of one that may be found offensive (or) suggest something unpleasant. Euphemisms are used for dissimulation, to refer to taboo topics, such as disability, sex, excretion, death in a polite way and to mask profanity. For instance, "The patient passed away" is a polite way when we compared with the statement like "The patient died".

2.2 Hedges

A linguistic variable carries with it the concept of fuzzy set qualifiers, called hedges. Hedges are terms that modify the shape of fuzzy sets. They include adverbs such as very, somewhat, quite, more or less, slightly, etc. In general, the hedges are of two types. They are Type I Hedges and Type II hedges.

2.2.1 Type I Hedge

Hedges in this category can be represented as operators acting on a fuzzy set. Typical hedges in this category are: very, more or less, much, slightly, highly.

2.2.2 Type Ii Hedge

Hedges in this category require a description of how they act on the components of the operand. Typical hedges in this category are: essentially, technically, actually, strictly, in a sense, practically, virtually, regular, etc.

2.2.3 Mathematical Expression for Certain Hedges

Hedge	Mathematical Expression
Little	$[\mu_A(x)]^{1.3}$
Slightly	$[\mu_A(x)]^{1.7}$
Very	$[\mu_A(x)]^2$
Extremely	$[\mu_A(x)]^3$
Vey very	$[\mu_A(x)]^4$
More or less	$[\mu_A(x)]^{1/2}$
Somewhat	$[\mu_A(x)]^{1/2}$

Fig(1): Mathematical Hedge Representation

2.2.4 Structure of Hedge Algebras

Let us consider the set of all possible truth values $T = \{\text{true, false, very true, very false, approximately true, possibly true, approximately true or possibly true, approximately true and possibly true, less true, less false, etc.}\}$. By using the above truth values, we have the following semantically ordered relation properties.

2.2.5 Properties of Semantically Ordered Relation

Based on the truth values mentioned above, we have the following semantic relations. They are;

- (i) True > false
- (ii) Very true > true
- (iii) Very false < false
- (iv) Approximately true < true
- (v) Little approximately true < approximately true < true
- (vi) Approximately true < very approximately true < true
- (vii) Little true \leq approximately true
- (viii) Possibly little true \leq little approximately true, etc.

2.3 Complete Residuated Lattices

Complete residuated lattice is a algebra, $L = \langle L, \wedge, \vee, \otimes, \rightarrow, 0, 1 \rangle$ with $\langle L, \wedge, \vee, 0, 1 \rangle$ be the complete lattice with 0 and 1 be the least and upper element of L, respectively; $\langle L, \otimes, 1 \rangle$ is a commutative monoid (i.e. \otimes is commutative, associative, and $a \otimes 1 = 1 \otimes a = a$ for each a belongs to L); \otimes and \rightarrow satisfy adjointness property: $a \otimes b \leq c$ iff $a \leq b \rightarrow c \forall a, b, c \in L$.

2.4 Truth value of a statement:

The truth or falsity of a statement is called its truth value. If a statement is true, we say that its truth value is TRUE or T and if it is false, we say that its truth value is FALSE or F. Then statements are widely classified into two types. They are simple and compound statements.

2.4.1 Simple statements:

A statement is said to be simple if it cannot be broken into two or more statements.

2.4.2 Compound statements:

If a statement is the combination of two or more simple statements, then it is said to be a compound statement.

2.4.3 Basic logical connectives:

The words which combine simple statements to form compound statements are called connectives. There are three logical connectives. We use the connectives ‘and’, ‘or’, etc., to form new statements by combining two or more statements. But the use of these connectives in English language is not always precise. Hence it is necessary to define a set of connectives with definite meanings in the language of logic, called object language. Three basic connectives are conjunction which corresponds to the English word ‘and’, ‘disjunction’ which corresponds to the word ‘or’ ‘negation’ which corresponds to the word ‘not’.

2.4.4 Conjunction:

If two simple statements p and q are connected by the word ‘and’, then the resulting compound statement ‘p and q’ is called the conjunction of p and q and is written in symbolic form as $P \wedge Q$. There are several rules in constructing conjunction. They are;

Rule (1): The statement $P \wedge Q$ has the truth value T whenever both p and q have the truth value T.

Rule (2): The statement $P \wedge Q$ has the truth value F whenever either p or q or both have the truth value F.

2.4.5 Disjunction:

If two simple statements p and q are connected by the word ‘or’, then the resulting compound statement ‘p or q’ is called the disjunction of p and q and is written in symbolic form as $P \vee Q$.

Rule (1): The statement $P \vee Q$ has the truth value F whenever both p and q have the truth value F.

Rule (2): The statement $P \vee Q$ has the truth value T whenever either p or q or both have the truth value T.

2.4.6 Negation:

The negation of a statement is generally formed by introducing the word ‘not’ at some proper place in the statement or by prefixing the statement with ‘It is not the case that’ or ‘It is false that’. If p denotes a statement, then the negation of p is written as $\sim P$.

Rule: If the truth value of p is T then the truth value of $\sim P$ is F. Also, if the truth value of p is F, then the truth value of $\sim P$ is T. We sum of the truth values of the different operators in the following table.

P	Q	$P \wedge Q$	$P \vee Q$	$\sim P$	$\sim Q$
T	T	T	T	F	F
T	F	F	T	F	T
F	T	F	T	T	F
F	F	F	F	T	T

Fig(2): Basic logic connectives

III. CASE STUDY

3.1 After the Funeral

Richard Abernethie was the eldest of seven. His young brother is Timothy Abernethie and his young sister was Cora Abernethie. Richard Abernethie was a wealthy person but affected by a serious disease. Doctor examined Richard's health and suggested that his condition is too bad. So Richard wanted to divide his wealth with his blood relations. Richard also had a nephew and two nieces. Richard had spent his life time with his nephew and his two nieces. Richard wanted to divide his wealth into six portions and the six members he quoted in his will are, Timothy Abernethie, Cora, his nephew George, then two nieces, and the last portion is for his brother Leo's widow. One day Richard was found dead in his sleep. But Cora argued that his death was not natural and it was a crime. But doctor's reports said that it was a sudden demise, it was an unexpected one and it was a natural death. It caused some doubt among the family members. Mr. Entwhistle, Richard's family lawyer, read Richard's will in the Enderby Hall, where all the family members were present and the wealth has been shared by six of his family members. For four of them the portion was directly given as properties and the remaining two, the young sister and brother of Richard, had a lifetime income from his wealth. The house of Richard and the things owned by him were kept for auction. The auction would take place later. But after the funeral, the next day Cora was found dead, brutally murdered in sleep by repeated blows with a Hatchet. Motive of the murder was not obvious. One possible motive was to suppress anything that Richard might have told Cora about his suspicions that he was being poisoned. These had been overheard by her paid companion, the timid Miss Gilchrist. Then Mr. Entwhistle asked Hercule Poirot to take over the case and find the murderer.

Entwhistle called on his long-time friend, Hercule Poirot, to resolve any doubts about the death of Richard. Poirot employed an old friend, Mr. Goby, to investigate the family. Mr. Goby, a most resourceful man, collected number of reasons for the family members who were in desperate need for the money from Richard Abernethie's estate. Mr. Goby employed all his skills to uncover the most private information, using agents who pose as actors, lawyers or even Catholic nuns. None of the family members could be cleared of suspicion. Poirot warned Entwhistle that Miss Gilchrist may herself be a target for the murderer.

Mrs. Cora has been a keen artist and collector of paintings from local sales. Susan Banks, learning that she inherited her Aunt Cora's property, went to her cottage to clear up the possessions and ready them for auction. She reviewed Cora's own paintings as well as those Cora had purchased at local sales. The next day, after Cora's funeral, an old friend who is an art critic, Alexander Guthrie, arrived to look through Cora's recent purchases.

Inspector Morton investigated Cora's murder. The Inspector Morton and Hercule Poirot shared information as they gathered. Morton focused on people in the area of Cora's rented cottage. Poirot focused on the Abernethie family, and a number of red herrings come to light.

3.1.1 Similarities:

- ❖ Rosamund Shane, one of the nieces, is a beautiful but determined woman who seems to have something to hide (which turns out to be her husband's infidelity and her own pregnancy).
- ❖ Susan's husband, Gregory, is a dispensing chemist who had been responsible for deliberately administering a nonlethal overdose to an awkward customer. In a surprising twist, he confesses to the murder of Richard Abernethie at the end. He possesses a psychological complex to perish people.
- ❖ Timothy Abernethie, an unpleasant man preoccupied with his own health perhaps to gain attention, might have murdered Cora, along with his country-tweed, strong, healthy wife, Maude.
- ❖ Even the gentle Helen Abernethie left Enderby to fetch her things from her London flat upon agreeing to stay longer at Enderby.
- ❖ In short, all the family had been alone on the day Cora was murdered, for enough time to reach the rented cottage and commit the murder.

3.1.2 Murderer in the Net

Poirot called all those involved together to observe them directly, his habitual method, via Entwhistle. They gathered to look over and select items of interest before the estate auction. This lured even the reclusive Timothy from his home, back to the family mansion of Enderby, bringing his wife Maude and Miss Gilchrist, who is now assisting them.

After playing games in mirrors, Helen Abernethie telephoned Entwhistle early the next morning with the news that she had realized what struck her odd on the day of the funeral. Before she could complete her conversation, she was savagely struck on the head. Mr. Entwhistle was left speaking out over a telephone where no one was listening. Poirot's explanation in the denouement is a startling one. He gathered those at Enderby Hall, his capacity as detective. Helen was safely away to recover from her concussion. Added to the group is Inspector Morton, whose own investigations lead him out of his home county of Berkshire to Enderby Hall, increasing the tensions for the family. Inspector Morton spent the afternoon asking each member of the family to account for themselves on the day of Cora's murder.

3.1.3 Impersonification

Cora had never come to the funeral at all. It was Miss Gilchrist, who disguised herself as Cora as part of a complicated plot for her own gain, leaving Cora home asleep from a sedative in her tea. She wished to plant the idea that Richard's death had been a murder. Therefore when Cora herself was murdered, it would seem that the alleged murderer had struck again. None of the family had seen Cora for over 20 years, due to the ill feeling caused at the time of her marriage. Miss Gilchrist had successfully copied her mannerisms, well enough to fool those who had known her as adults. The flaw in her portrayal of Cora was spotted by Helen Abernethie. Miss Gilchrist had rehearsed a characteristic turn of the head in a mirror, where the reflection is a reverse of reality. When she came to the house after the funeral, she turned her head to the left, not to the right.

Helen had had the feeling that something was wrong when Cora had made her startling statement, but took some days and a timely conversation among the young cousins to realize precisely what it was.

3.1.5 Meticulous Mistakes

Shane Rosamund –Pregnancy due to sexual relationship with her husband

Gregory (husband of Susan) – Chemist – overdose given to Richard

Miss. Gilchrist – took poison in the cake

Helen Abernethie – Doubted in mannerism

In the book of A. Christie's "*After the Funeral* (1946)" [1], the following page numbers represent the misleading points.

Page no – 157,180 shows the argument " Miss Gilchrist took poison"

Page no – 269 main symmetrical prediction revealed.

3.2 Fuzzy Application

Based on the thorough study of Agatha Christie's "*After the Funeral*", the following predictions were made;

3.2.1 Ordering in Will Separation:

- (1) Thimothy Abernethie, Richard's Brother
- (2) George Crossfield, Richard's Nephew
- (3) Susan Banks, Richard's Niece
- (4) Rosamund Shane, Richard's Niece
- (5) To Trust; income paid to Mrs. Helen Abernethie, Richard's Sister-in-law
- (6) To Trust; Lifetime income to Mrs. Cora Lanquet, Richard's younger Sister

3.2.2 Sequential ordering of Richard invitation to his family personals before his death:

- (1) George Richard's Nephew
- (2) Susan Richard's Niece
- (3) Gregory Banks, Susan's Husband
- (4) Rosamand Shane, Richard's Niece
- (5) Helen Abernethie, Richard's Sister-in-law
- (6) Cora, Richard's Younger Sister

3.2.3 Sequential ordering on Happenings during the funeral of Richard:

- (1) Cora's statement " it was a murder"
- (2) Cora's mannerism
- (3) Helen's view upon wax flowers
- (4) Cora's view upon wax flowers
- (5) Helen frowned that something wrong
- (6) Cora's urgency to leave the funeral

In the book of A. Christie's "*After the Funeral* (1946)"[1], the following page numbers represent the above orderings.

Page no – 27

3.2.4 Ordering elements on Cora's death:

- (1) Cora with her companion Miss.Gilchrist
- (2) Doctor's opinion about cora's death around 2-4.30
- (3) Few trinkets were stolen
- (4) Few thousands
- (5) Not seeing Thimothy Abernethie in the funeral (oral statement by Miss. Gilchrist)

In the book of A. Christie's "*After the Funeral*(1946)"[1], the following page numbers represent the above orderings.

Page no – 32, 46

Based on the statements revealed in the earlier part of the novel, we have sorted out using the semantically ordered relation between the suspects and their business on the day Aunt Cora was brutally murdered.

3.2.5 Semantically Ordered Statement Results

- (1) George may have been at Hurst park race – true
- (2) George may urgent need for money at the time of uncle's death – very true
- (3) Rosamund Shane out for shopping in London – true
- (4) Michael Shane out for shopping in London – true
- (5) Susan Banks were at home all the day – more true
- (6) Timothy Abernethie since he was ill he was in home taking rest – more true
- (7) Maude Thimothy driving herself from Enderby Hall – very true
- (8) Helen Abernethie was in Enderby Hall along with servants – more true
- (9) Lanscombe was in Enderby hall throughout the day – very true

In the book of A. Christie's "*After the Funeral*(1946)"[1], the following page numbers represent the above mentioned orderings.

Page no – 57, 77, 97, 99

3.2.6 Semantic Filtering

Now the above relation have been filtered, by knowing the truth behind the original statements and analyse it with the suspicious statements reveals at the end of the novel.

(1) George Crossfield

(a) Original Statement: he was in urgent need of money – very true

Suspicious Statement: no evidence to saying so

Filtration: False

(b) Original Statement: George may have been at Hurst park races

Suspicious Statement: no evidence to saying so

Filtration: False

In the book of A. Christie's "*After the Funeral*(1946)"[1], the following page numbers represent the above mentioned filtration.

Page no – 170, 171

(2) Gregory Banks

Original Statement: he was in home for the whole day

Suspicious Statement: phone out of order

Filtration: Possibly true

In the book of A. Christie's "*After the Funeral*(1946)"[1], the following page numbers represent the above mentioned filterings.

Page no – 235, 236

(3) Helen Abernethie

Original Statement: was in Enderby Hall along with servants

Suspicious Thing: More innocent

Filtration: very true

In the book of A. Christie's "*After the Funeral*(1946)"[1], the following page numbers represent the above mentioned filtration.

Page no – 118, 272

(4) Michael Shane

Original Statement: he was in shopping

Suspicious Statement: phone out of order

Truth reveals at the end: was in business meeting with Mr. Rosenhein and Mr Oscar Lewis
 Supporting Elements: 12 'o' clock hired a car and returned in the evening, about 5.
 Filtration: very very false
 (5) Maude Abernethie
 Original Statement: drove car from Enderby hall around 2 pm
 Suspicious Statement: stayed in small inn, due to car breakdown and didn't came back to inn till late night
 Supporting element: Cora death time limit possible between 2-4.30pm
 Filtration: very very false
 (6) Susan Banks
 Original Statement: was in home all the day
 Suspicious Statement: Susan's car in Mrs. Cora's land
 Supporting Element: she didn't see cora and also she didn't notice the broken window
 Filtration: very very false
 (7) Miss Gilchrist
 (a) Original Statement: becoming ill, after taking wedding cake, which was come by the post?
 Suspicious Statement: post van driver argues that, he did not deliver that wedding cake
 Supporting Elements: missing of stamp in that post cover
 Filtration: Very very true
 (b) Original Statement: what happened to the wax flowers, on that malachite table?
 Suspicious Statement: This was the first time that she (Miss. Gilchrist) arriving Enderby Hall.
 Supporting Element: She could not have seen them there, because they had been broken and put away before she arrived.
 Filtration: very very true
 In the book of A. Christie's "*After the Funeral* (1946)"[1], the following page numbers represent the above mentioned filtration.
 Page no – 145

3.2.7 Symmetric Relation Confirms The Murderer

The left right discrepancy in the mirror reflection helped to solve the mystery. The criminal Miss. Gilchrist came to a family gathering, impersonating an aunt of the family who is supposed to be returning after a long time. The aunt had a peculiar gesture of bending her head to the right, while talking. The criminal practised this gesture and used it. But as she practised in front of a mirror, she had bent her head to the left and was finally caught.
 In the book of A. Christie's "*After the Funeral*(1946)"[1], the following page numbers represent the above mentioned symmetric relation.
 Page no – 18, 26

3.3 Lattice Structure Application

With our collected statements and filtration, we can establish those elements in the form of Lattice Hedge Structure. Throughout the novel, we have 14 main suspects, 9 mental suspicious evidences and 13 object oriented evidences. Here we establish the lattice structure for the first two important suspects.

3.3.1 Suspects:

S₁ = Mrs. Helen Abernethie

S₂ = Miss Gilchrist
 S₃ = Mrs. Maude Abernethie
 S₄ = Mr. Thimothy Abernethie
 S₅ = Mr. Gregory Banks
 S₆ = Mrs. Susan Banks
 S₇ = Mr. Michael Shane
 S₈ = Mrs. Rosamund Shane
 S₉ = lanscombe
 S₁₀ = Mrs. Cora Lanquenent
 S₁₁ = Mr. Guthirie
 S₁₂ = Nuns
 S₁₃ = Mr. Entwistle
 S₁₄ = Mr. Richard Abernethie

3.3.2 Mental Suspicion:

M₁ = known to Richard
 M₂ = known to Cora
 M₃ = connection with Richard's day of death
 M₄ = connection with cora's day of death
 M₅ = Richard's plan to visit and reject
 M₆ = vagueness in Cora's statement
 M₇ = suspicion, assumption (Richard's death)
 M₈ = fond of Cora
 M₉ = conversation between Cora and Richard

3.3.3 Physical Suspicion:

P₁ = will
 P₂ = employment
 P₃ = disguise
 P₄ = piousness wedding cake
 P₅ = hatchet
 P₆ = oil painting smell
 P₇ = on picture post card
 P₈ = bouquet of wax flowers
 P₉ = was at Hurst park races
 P₁₀ = shopping
 P₁₁ = were at home all day
 P₁₂ = driving
 P₁₃ = urgent need of money

3.4 Distributive Hedge Representation

By discussing every suspect with all the mental and physical suspicious elements, we arriving with following kind of semantically ordered distributive relations. Here we address Helen Abernethie's suspicious act and the results.

Suspect Name: Mrs. Helen Aberniethie

$$S_1 \vee (M_1 \wedge P_1) = (S_1 \vee M_1) \wedge (S_1 \vee P_1) = (\text{true}) \wedge (\text{possibly true}) = \text{possibly true}$$

$$S_1 \vee (M_2 \wedge P_1) = (S_1 \vee M_2) \wedge (S_1 \vee P_1) = (\text{approximately true}) \wedge (\text{possibly true}) = \text{possibly true}$$

$$S_1 \vee (M_3 \wedge P_1) = (S_1 \vee M_3) \wedge (S_1 \vee P_1) = (\text{true}) \wedge (\text{possibly true}) = \text{possibly true}$$

$$S_1 \vee (M_4 \wedge P_1) = (S_1 \vee M_4) \wedge (S_1 \vee P_1) = (\text{more or less false}) \wedge (\text{possibly true}) = \text{more or less false}$$

$$S_1 \vee (M_5 \wedge P_1) = (S_1 \vee M_5) \wedge (S_1 \vee P_1) = (\text{true}) \wedge (\text{possibly true}) = \text{possibly true}$$

$$S_1 \vee (M_6 \wedge P_1) = (S_1 \vee M_6) \wedge (S_1 \vee P_1) = (\text{more or less true}) \wedge (\text{possibly true}) = \text{possibly true}$$

$$S_1 \vee (M_7 \wedge P_1) = (S_1 \vee M_7) \wedge (S_1 \vee P_1) = (\text{less false}) \wedge (\text{possibly true}) = \text{very true}$$

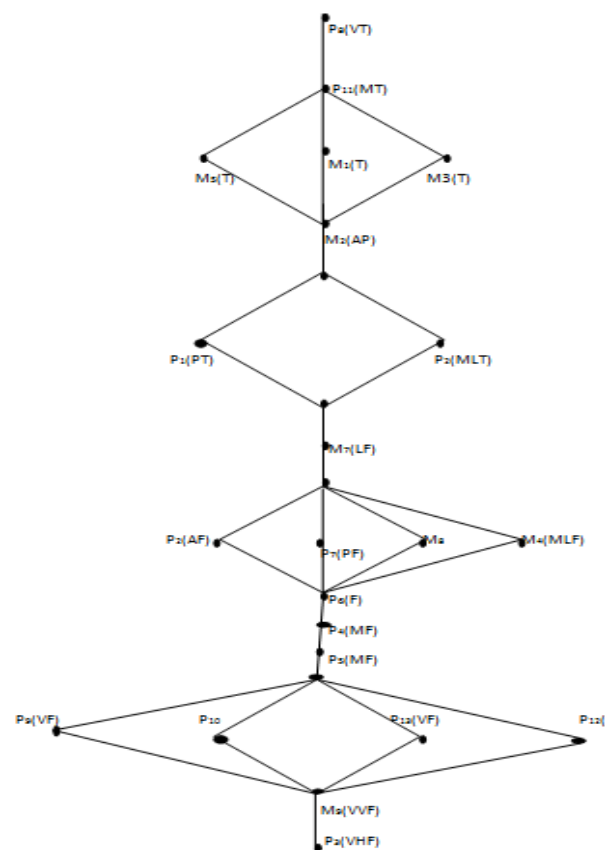
$$S_1 \vee (M_8 \wedge P_1) = (S_1 \vee M_8) \wedge (S_1 \vee P_1) = (\text{possibly false}) \wedge (\text{possibly true}) = \text{possibly false}$$

$S_1 \vee (M_9 \wedge P_8) = (S_1 \vee M_9) \wedge (S_1 \vee P_8) = (\text{very very false}) \wedge (\text{very true}) = \text{very very false}$
 $S_1 \vee (M_1 \wedge P_9) = (S_1 \vee M_1) \wedge (S_1 \vee P_9) = (\text{true}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_2 \wedge P_9) = (S_1 \vee M_2) \wedge (S_1 \vee P_9) = (\text{approximately true}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_3 \wedge P_9) = (S_1 \vee M_3) \wedge (S_1 \vee P_9) = (\text{true}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_4 \wedge P_9) = (S_1 \vee M_4) \wedge (S_1 \vee P_9) = (\text{more or less false}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_5 \wedge P_9) = (S_1 \vee M_5) \wedge (S_1 \vee P_9) = (\text{true}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_6 \wedge P_9) = (S_1 \vee M_6) \wedge (S_1 \vee P_9) = (\text{more or less true}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_7 \wedge P_9) = (S_1 \vee M_7) \wedge (S_1 \vee P_9) = (\text{less false}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_8 \wedge P_9) = (S_1 \vee M_8) \wedge (S_1 \vee P_9) = (\text{possibly false}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_9 \wedge P_9) = (S_1 \vee M_9) \wedge (S_1 \vee P_9) = (\text{very very false}) \wedge (\text{very false}) = \text{very very false}$
 $S_1 \vee (M_1 \wedge P_{10}) = (S_1 \vee M_1) \wedge (S_1 \vee P_{10}) = (\text{true}) \wedge (\text{very false}) = \text{very false}$
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 $S_1 \vee (M_6 \wedge P_{10}) = (S_1 \vee M_6) \wedge (S_1 \vee P_{10}) = (\text{more or less true}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_7 \wedge P_{10}) = (S_1 \vee M_7) \wedge (S_1 \vee P_{10}) = (\text{less false}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_8 \wedge P_{10}) = (S_1 \vee M_8) \wedge (S_1 \vee P_{10}) = (\text{possibly false}) \wedge (\text{very false}) = \text{very false}$
 $S_1 \vee (M_9 \wedge P_{10}) = (S_1 \vee M_9) \wedge (S_1 \vee P_{10}) = (\text{very very false}) \wedge (\text{very false}) = \text{very very false}$
 $S_1 \vee (M_1 \wedge P_{11}) = (S_1 \vee M_1) \wedge (S_1 \vee P_{11}) = (\text{true}) \wedge (\text{more true}) = \text{true}$
 $S_1 \vee (M_2 \wedge P_{11}) = (S_1 \vee M_2) \wedge (S_1 \vee P_{11}) = (\text{approximately true}) \wedge (\text{more true}) = \text{approximately true}$
 $S_1 \vee (M_3 \wedge P_{11}) = (S_1 \vee M_3) \wedge (S_1 \vee P_{11}) = (\text{true}) \wedge (\text{more true}) = \text{true}$
 $S_1 \vee (M_4 \wedge P_{11}) = (S_1 \vee M_4) \wedge (S_1 \vee P_{11}) = (\text{more or less false}) \wedge (\text{more true}) = \text{more or less false}$
 $S_1 \vee (M_5 \wedge P_{11}) = (S_1 \vee M_5) \wedge (S_1 \vee P_{11}) = (\text{true}) \wedge (\text{more true}) = \text{true}$
 $S_1 \vee (M_6 \wedge P_{11}) = (S_1 \vee M_6) \wedge (S_1 \vee P_{11}) = (\text{more or less true}) \wedge (\text{more true}) = \text{more or less true}$
 $S_1 \vee (M_7 \wedge P_{11}) = (S_1 \vee M_7) \wedge (S_1 \vee P_{11}) = (\text{less false}) \wedge (\text{more true}) = \text{less false}$
 $S_1 \vee (M_8 \wedge P_{11}) = (S_1 \vee M_8) \wedge (S_1 \vee P_{11}) = (\text{possibly false}) \wedge (\text{more true}) = \text{possibly false}$
 $S_1 \vee (M_9 \wedge P_{11}) = (S_1 \vee M_9) \wedge (S_1 \vee P_{11}) = (\text{very very false}) \wedge (\text{more true}) = \text{very very false}$
 $S_1 \vee (M_1 \wedge P_{12}) = (S_1 \vee M_1) \wedge (S_1 \vee P_{12}) = (\text{true}) \wedge (\text{more true}) = \text{true}$
 $S_1 \vee (M_2 \wedge P_{12}) = (S_1 \vee M_2) \wedge (S_1 \vee P_{12}) = (\text{approximately true}) \wedge (\text{more true}) = \text{approximately true}$
 $S_1 \vee (M_3 \wedge P_{12}) = (S_1 \vee M_3) \wedge (S_1 \vee P_{12}) = (\text{true}) \wedge (\text{more true}) = \text{true}$
 $S_1 \vee (M_4 \wedge P_{12}) = (S_1 \vee M_4) \wedge (S_1 \vee P_{12}) = (\text{more or less false}) \wedge (\text{more true}) = \text{more or less false}$
 $S_1 \vee (M_5 \wedge P_{12}) = (S_1 \vee M_5) \wedge (S_1 \vee P_{12}) = (\text{true}) \wedge (\text{more true}) = \text{true}$

$S_1 \vee (M_6 \wedge P_{12}) = (S_1 \vee M_6) \wedge (S_1 \vee P_{12}) = (\text{more or less true}) \wedge (\text{more true}) = \text{more or less true}$
 $S_1 \vee (M_7 \wedge P_{12}) = (S_1 \vee M_7) \wedge (S_1 \vee P_{12}) = (\text{less false}) \wedge (\text{more true}) = \text{less false}$
 $S_1 \vee (M_8 \wedge P_{12}) = (S_1 \vee M_8) \wedge (S_1 \vee P_{12}) = (\text{possibly false}) \wedge (\text{more true}) = \text{possibly false}$
 $S_1 \vee (M_9 \wedge P_{12}) = (S_1 \vee M_9) \wedge (S_1 \vee P_{12}) = (\text{very very false}) \wedge (\text{more true}) = \text{very very false}$
 $S_1 \vee (M_1 \wedge P_{13}) = (S_1 \vee M_1) \wedge (S_1 \vee P_{13}) = (\text{true}) \wedge (\text{more true}) = \text{true}$
 $S_1 \vee (M_2 \wedge P_{13}) = (S_1 \vee M_2) \wedge (S_1 \vee P_{13}) = (\text{approximately true}) \wedge (\text{more true}) = \text{approximately true}$
 $S_1 \vee (M_3 \wedge P_{13}) = (S_1 \vee M_3) \wedge (S_1 \vee P_{13}) = (\text{true}) \wedge (\text{more true}) = \text{true}$
 $S_1 \vee (M_4 \wedge P_{13}) = (S_1 \vee M_4) \wedge (S_1 \vee P_{13}) = (\text{more or less false}) \wedge (\text{more true}) = \text{more or less false}$
 $S_1 \vee (M_5 \wedge P_{13}) = (S_1 \vee M_5) \wedge (S_1 \vee P_{13}) = (\text{true}) \wedge (\text{more true}) = \text{true}$
 $S_1 \vee (M_6 \wedge P_{13}) = (S_1 \vee M_6) \wedge (S_1 \vee P_{13}) = (\text{more or less true}) \wedge (\text{more true}) = \text{more or less true}$
 $S_1 \vee (M_7 \wedge P_{13}) = (S_1 \vee M_7) \wedge (S_1 \vee P_{13}) = (\text{less false}) \wedge (\text{more true}) = \text{less false}$
 $S_1 \vee (M_8 \wedge P_{13}) = (S_1 \vee M_8) \wedge (S_1 \vee P_{13}) = (\text{possibly false}) \wedge (\text{more true}) = \text{possibly false}$
 $S_1 \vee (M_9 \wedge P_{13}) = (S_1 \vee M_9) \wedge (S_1 \vee P_{13}) = (\text{very very false}) \wedge (\text{more true}) = \text{very very false}$

By observing the above distributive equations, most of them were result with the value belongs to the false family.

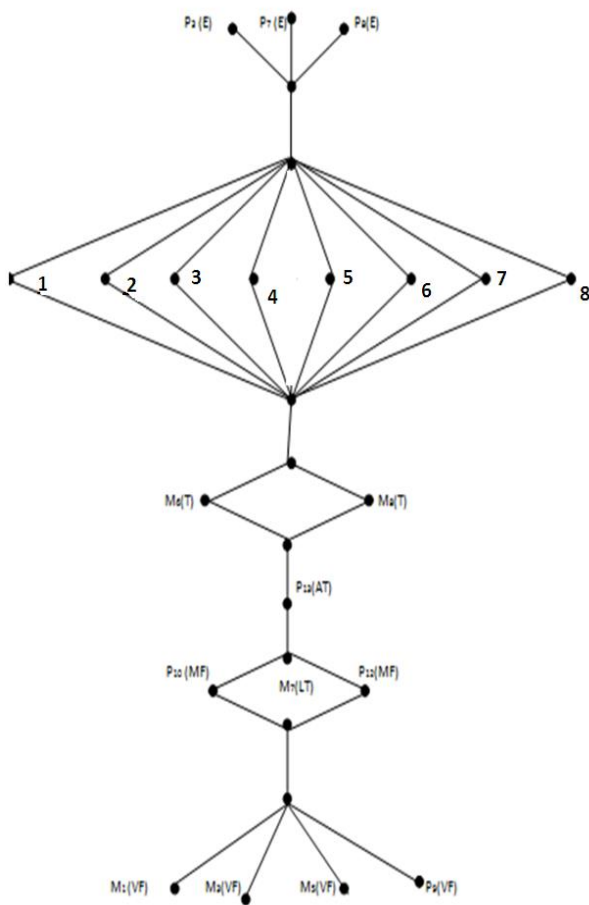
Based on the above truth statements and concepts, we ordered both the evidences with using hedge operator in it. So the structure we mentioned above is equipped with the concepts that handled out by the respective suspects, we can also compare this result with the graph namely Conceptual graph.



Fig(3): Lattice Hedge Representation of Helen Abernethie's suspicious things.

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Fig(4): Lattice Hedge Representation of Miss. Gilchrist’s suspicious things.

In the above figure, the numbers 1,2,3,4,5,6,7,8 represent M_2 = known to Cora, M_4 = connection with Cora’s death day, M_9 = conversation between Richard and Cora, P_1 = will, P_2 = employment, P_4 = piousness wedding cake, P_5 = hatchet, P_6 = oil painting smell respectively and all these suspicious elements supports with the degree very true.

IV. RESULT

Fig(4) shows that Miss Gilchrist has been suspected more by the semantic classification and she was the only suspect who represents three main physical mistakes (i.e., P_3 = disguise, P_7 = picture post card, P_8 = bouquet of wax flowers) at the most extreme level (very very true) and also supported with M_2 = known to Cora, M_4 = connection with Cora’s death day, M_9 = conversation between Richard and Cora, P_1 = will, P_2 = employment, P_4 = piousness wedding cake, P_5 = hatchet, P_6 = oil painting smell to the confirmatory level (very true).

V. CONCLUSION

In this paper, many interesting properties of Hedge Algebra have been examined and we introduce them into the literary application of Agatha Christie’s Crime Thrillers. And also we removed the vagueness by framing the sequences into a semantically ordering relation and arrived with an exact solution.