Key Indicator - 2.3 Teaching - Learning Process

2.3.1 Student centric methods, such as experiential learning, participative learning and problem-solving methodologies are used for enhancing learning experience and teachers use ICT- enabled tools including online resources for effective teaching and learning process.

Participative Learning - Student Research Publication

The way the academic community interacts with the outside world is through research. Research take many different forms, and it encompasses academic and artistic pursuits that can provide new information, strengthen our capacity to solve issues, produce new theories, and result in the production of new works of art or artistic performances.

Research develops the following in students.

- Improves capacity for problem solving.
- Updates the comprehension of research techniques.
- Increases the knowledge in the subject.
- More independence and assurance.
- Improves the knowledge of the education and employment paths.

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PG AND RESEARCH DEPARTMENT OF MATHEMATICS

P.CHITRA, II M.SC MATHEMATICS

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Formation of Diophantine Triples Involving Heptagonal Pyramidal Numbers

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***Abstract:** In this paper, we seek for three specific polynomials with integer coefficients to such an extent that the product of any two numbers expanded by a non-zero number (or polynomials with integer coefficients) is a perfect square.*
***Keywords:** Diophantine triples, heptagonal pyramidal number, triples, perfect square, pyramidal number.*

Notation
$P_n^7 = \frac{n(n+1)}{6}(5n-2)$, heptagonal pyramidal number of rank n.

I. INTRODUCTION

A Diophantine equation is a polynomial equation in number theory where only the integer solutions are considered or searched for, typically with two or more unknowns [1-4]. The term "Diophantine" refers to the Greek mathematician Diophantus of Alexandria, who investigated similar situations and was one of the pioneers in introducing symbolism to variable-based mathematics in the third century.
The problem of the occurrence of Dio triples and quadruples with the property $D(n)$ for any integer n as well as for any linear polynomial in n was studied by a number of mathematicians [5-8]. In this particular situation, one may turn to [9–16] for a thorough analysis of various difficulties on Diophantine triples. Half companion Diophantine triple sequences were studied in [17]. These results motivated us to examine for Diophantine triples with involving heptagonal pyramidal numbers. This paper aims at constructing Dio-Triples where the product of any two members of the triple with the addition of a non-zero integer or a polynomial with integer coefficients satisfies the required property. Also, we present three sections where in each of which we find the Diophantine triples from heptagonal pyramidal number of different ranks with their corresponding properties.

II. BASIC DEFINITION

A set of three distinct polynomials with integer coefficients (a_1, a_2, a_3) is said to be Diophantine triple with property $D(n)$ if $a_i * a_j + n$ is a perfect square for all $1 \leq i < j \leq 3$, where n may be non zero or polynomial with integer coefficients.

III. METHOD OF ANALYSIS:

A. Section-A

Formation of Diophantine triples involving heptagonal pyramidal number of rank n and $n-1$
Let $a = 6p_n^7$ and $b = 6p_{n-1}^7$ be heptagonal pyramidal numbers of rank n and $n-1$ respectively. Then,

$$ab + (-3n^5 - 4n^4 + 5n^3 + 20n^2 - 8n + 1)$$
$$= 25n^6 - 50n^5 - 15n^4 + 50n^3 + 6n^2 - 8n + 1$$
$$= (5n^3 - 5n^2 - 4n + 1)^2$$

$b + (-3n^5 - 4n^4 + 5n^3 + 20n^2 - 8n + 1) = (5n^3 - 5n^2 - 4n + 1)^2 = \alpha^2$ (say) (1)
$bc + (-3n^5 - 4n^4 + 5n^3 + 20n^2 - 8n + 1) = \beta^2$ (2)
$ca + (-3n^5 - 4n^4 + 5n^3 + 20n^2 - 8n + 1) = \gamma^2$ (3)

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Diophantine Triples Involving Octagonal Pyramidal Numbers

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***Abstract:** In this work, we strive for three particular polynomials with integer coefficients that may be expanded by non-zero values to the position where the product of any two numbers is a perfect square.*
***Keywords:** Diophantine triples, octagonal pyramidal number, triples, perfect square, pyramidal number.*

Notation

$P_n^8 = \frac{n(n+1)}{6}[6n-3]$, octagonal pyramidal number of rank n

I. INTRODUCTION

In number theory, a Diophantine equation is a polynomial equation with two or more unknowns that solely considers or searches for integer solutions [1-4]. The term "Diophantine" relates to the Greek mathematician Diophantus of Alexandria who, in the third century, pioneered the introduction of symbolism to variable-based mathematics and studied related problems. Numerous mathematicians have investigated the issue of the occurrence of Dio triples and quadruples with the property D(n) for any integer n as well as for any linear polynomial in n [5-8]. In this case, [9-16,18 &19] provides a full study of the many challenges on Diophantine triples. Triple sequences with a half companion sequences were examined in [19].

Our search for Diophantine triples utilising octagonal pyramidal numbers was prompted by these findings. This study tries to build Dio-Triples that satisfy the necessary property when the product of any two of the triple's members plus a non-zero integer or a polynomial with integer coefficients is added. The Diophantine triples from octagonal pyramidal numbers of various ranks are also presented in each of the three parts along with the relevant features.

II. BASIC DEFINITION

A set of three distinct polynomials with integer coefficients (a_1, a_2, a_3) is said to be **Diophantine triple** with property $D(n)$ if $a_i * a_j + n$ is a perfect square for all $1 \le i < j \le 3$, where n may be non zero or polynomial with integer coefficients.

III. METHOD OF ANALYSIS

A. Section-A

Construction of the Diophantine triples involving octagonal pyramidal number of rank n and $n-1$

Let $a = 6P_n^8$ and $b = 6P_{n-1}^8$ be octagonal pyramidal numbers of rank n and $n-1$ respectively. Then,

$ab + (-3n^4 - 24n^3 + 43n^2) = (6n^3 - 6n^2 - 4n)^2$

Hence, $ab + (-3n^4 - 24n^3 + 43n^2) = \alpha^2$ (say) (1)

$bc + (-3n^4 - 24n^3 + 43n^2) = \beta^2$ (2)

$ca + (-3n^4 - 24n^3 + 43n^2) = \gamma^2$ (3)

Solving (2) & (3)

$(b - a)(3n^4 + 24n^3 - 43n^2) = (a\beta^2 - b\gamma^2)$ (4)

Put, $\beta = x + by$ and $\gamma = x + ay$

Substituting β, γ in (4)

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An Integral Solution of Negative Pell Equation $x^2 = 5y^2 - 9^t$

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***Abstract:** We look for non-trivial integer solution to the equation $x^2 = 5y^2 - 9^t, t \in N$ for the singular choices of particular by (i) t = 2k (ii) t = 2k+1, $\forall k \in N$. Additionally, recurrence relations on the solutions are obtained.*

***Keywords:** Negative Pell equations, Pell equations, Diophantine equations, Integer solutions.*

I. INTRODUCTION

It is well known the Pell equation $x^2 - Dy^2 = 1$ (D > 0 and square free) has at all times positive integer solutions. When $N \neq 1$, the Pell equation $x^2 - Dy^2 = -N$ possibly will not boast at all positive integer solutions. In favour of instance, the equations $x^2 = 3y^2 - 1$ and $x^2 = 7y^2 - 4$ comprise refusal integer solutions.

This manuscript concerns the negative Pell equation $x^2 = 5y^2 - 9^t$, where t > 0 and infinitely numerous positive integer solutions are obtained for the choices of t known by (i) *t = 2k* (ii) *t = 2k+1*. Supplementary recurrence relationships on the solutions are consequent.

II. PRELIMINARY

The Pell equation is a Diophantine equation of the form $x^2 - dy^2 = 1$. Given *d*, we would like to find all integer pairs (*x, y*) that satisfy the equation. Since any solution (*x, y*) yields multiple solutions ($\pm x, \pm y$), we may restrict our attention to solutions where *x* and *y* nonnegative integer. We usually take *d* in the equation $x^2 - dy^2 = 1$ to be a positive non square integer. Otherwise, there are only uninteresting solutions: if *d < 0*, then (*x, y*) = ($\pm$1, 0) in the case *d<-1*, and (*x, y*)=(0, $\pm$1) or ($\pm$1, 0) in the case *d = -1*; if *d = 0*, then *x* = $\pm$ *1* (*y* arbitrary); and if a nonzero square, then dy^2 and x^2 are consecutive squares, implying that (*x, y*)=($\pm$1, 0). Notice that the Pell equation always has trivial solution (*x, y*) = (1, 0). We now investigate an illustrate case of Pell's equation and

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Non-Extendability of Special DIO 3-Tuples Involving Nonaganal Pyramidal Number

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***Abstract:** This paper concerns with the construction of three distinct polynomials with integer coefficients (a_1, a_2, a_3) such that the product of any two contribution of the set subtracted to their sum and improved by a non-zero integer (or a polynomial with integer coefficients) is a perfect square and this shows the non-extendability of Special Dio Quadruple.*
***Keywords:** Special Dio triples, Pyramidal number, Polynomials, Pell equation, Special Dio Quadruples.*

I. INTRODUCTION

Diophantine Analysis is the mathematical study of Diophantine Problems, which was initiated by Diophantus in third century. A set of m distinct positive integers $\{a_1, a_2, \ldots, a_m\}$ is said to have the property D(n) if the product any two members of the set is decreased by their sum and increased by a non-zero integer n, is a perfect square for all m elements. Such a set is called Diophantine m-tuples of size m. Many mathematicians considered the extension problem of Diophantine quadruples with the property D(n) for any arbitrary integer n and also for any linear polynomial.

In this communication, we have presented three sections, in each of which we find the Diophantine triples for nonagonal Pyramidal number with distinct ranks and the non-extendability of Special Dio quadruple.

A. Notation

PT_n^9 = Pyramidal number on nonagonal of rank n $= \frac{1}{6}n(n+1)(7n-4)$

B. Basic Definition

A set of three distinct polynomials with integer coefficients (a_1, a_2, a_3) is said to be a Special Dio 3-tuple with property D (n) if $a_i * a_j - (a_i + a_j) + n$ is a perfect square for all $1 \le i \le j \le 3$, where n may be non-zero integer or polynomial with integer coefficients.

II. METHOD OF ANALYSIS

A. Section-I

Construction of Special Dio 3-tuples for pyramidal number on nonagonal of rank $n-1$ and n.

Let $a = 6PT_{n-1}^9$, $b = 6PT_n^9$ be Pyramidal numbers on nonagonal of rank $n-1$ and n respectively, such that

$ab-(a+b)-7n^5-n^4+3n^3+58n^2-3n+1$ is a perfect square, say α^2.

Let c be any non-zero integer such that

$$ac-(a+c)-7n^5-n^4+3n^3+68n^2-3n+1=\beta^2 \quad (1)$$

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A New Direction Towards Plus weighted Grammar

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Abstract: The core of this paper is to establish plus weighted grammar and to illustrate the language accepted by the pwfa and pwg are equivalent.
Keywords: Plus weighted grammar, plus weighted automata, regular language.

I. INTRODUCTION

Weighted context free grammars and weighted finite automata were initially introduced in significant articles by Marcel-Paul Schutzenberger (1961) and Noam Chomsky (1963), respectively.Weighted finite automata are standard nondeterministic finite automata in which the transitions have weights.We consider the following scenarios to demonstrate the variation of weighted finite automata. We may determine the wide range of a word by counting the number of paths that can be used to represent it as follows: Let each transition have a weight of 1, and for a path that is taken again, the sum of the weights of its successful paths. The wide range of a word equals the sum of its successful paths' weights. The algebraic structures of a semiring involve the computations with weights in the previously mentioned illustration. Here the multiplication of semiring is utilised for estimating the weights of the paths and the weight of the word is successively predicted by the sum of the weights of its successful paths.Applications for weighted automata are numerous. Weighted automata and their accompanying algorithm are developed by contemporary spoken-dialog or handheld speech recognition systems to express their concepts and promote successful combination and search [1,7].

A plus weighted automata [8,9,10,11] is an automata that deals with plus weights up to infinity. Many algebraic structures of plus weighted automata has been discussed in [8,9,10]. A grammar related to this automata is proposed in this paper. This study is a generalisation of plus weighted multiset grammar [9].Plus weighted grammar (pwg) can also be extended further in right linear and left linear grammar. The plus weighted automata can be applied in max weighted automata cited as[2,3,4,5,6]. This work can be further motivated to work in field of graph theory [13,14,15,16].

In addition to this section, this paper comprises four more. Basic concepts and notions are discussed in Section 2 for usage in later parts. In Section 3, a new grammar called pwg is proposed which offers a fresh perspective on pwfa and it elaborates with illustration that for every plus weighted regular grammar there exists a pwfa. The final section, Section 4, concludes and describes the future extension of pwg.

II. PRELIMINARIES

In this section we review some basic notions and definitions about grammar and its types.

Definition 2.1 A phrase-structure grammar or grammar is a four tuple $G = < V_N, V_T, S, P >$ where, V_N is a set of non-terminal symbols, V_T is a set of terminal symbols called alphabets, S is a special element of V_N and is called the starting symbol, P is the production. Relation on $(V_T \cup V_N)^*$, the set of strings of elements of terminals and non-terminals.

Types of grammar

(i) Type 0 or unrestricted grammar:

A grammar in which there are no restrictions on its productions.(ii)Type 1 or context sensitive grammar:Grammar that contains only productions of the form $\alpha \rightarrow \beta$ where $|\alpha| \leq |\beta|$ and $\alpha, \beta \in (V_T \cup V_N)^*$.(iii) Type 2 or context free grammar:Grammar

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POWER-3 HERONIAN ODD MEAN LABELING FOR SOME SPECIAL GRAPHS

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Abstract: In this article, we discuss Power-3 Heronian odd Mean Labeling for some families of graphs. A function is said to be Power-3 Heronian odd mean labelling of a graph G with q edges, if f is a objective function from the vertices of G to the set{1,3,5,.......2p-1}such that when each edges uv is assigned the label. The resulting edge labels are distinct numbers.

$$\beta^*(e = uv) = \left\lfloor \sqrt[3]{\frac{\beta(u)^3 + (\beta(u)\beta(v))^{\frac{3}{2}} + \beta(v)^3}{3}} \right\rfloor$$

Keywords:

Mean labeling, multiplicative labeling, Additive labeling.

Introduction:

In this paper, the graphs are taken as simple, finite and undirected. Let V(G) denotes set of all vertices and E(G) denotes set of all edges .A graph labeling an assignment of integers at its vertices or edges under certain conditions. A vertex labeling is a function of V to a set of labels. A graph with such a vertex labeling function is defined as Vertex – labeled graph. An edge labeling is a function of E to a set of labels and a graph with such a function is called an edge labeled graph. In this article $P_n \odot K_{1,2}$, $P_n \odot K_{1,3}$, T_5, Quadrilateral snakes are discussed Power-3 Heronian odd Mean Labeling of Graphs. All Graphs in

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On Integer Solutions of the Ternary Quadratic Equation $3a^2+3r^2-2ar=332n^2$

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Abstract: ***Analysis is conducted on the non-trivial different integral solution to the quadratic equation $3a^2+3r^2-2ar=332n^2$. We derive distinct integral solutions in four different patterns. There are a few intriguing connections between the solutions and unique polygonal numbers that are presented.***

Keywords: Quadratic equation, integral solutions, polygonal numbers, special numbers, square number.

I. INTRODUCTION

Number theory is a vast and fascinating field of mathematics concerned with the properties of numbers in general and integers in particular as well as the wider classes of problems that arise from their study. Number theory has fascinated and inspired both amateurs and mathematicians for over two millennia. A sound and fundamental body of knowledge, it has been developed by the untiring pursuits of mathematicians all over the world. The study of Number theory is very important because all other branches depend upon this branch for their final results. The older term for number theory is "arithmetic". During the seventeenth century. The term "Number theory" was coined by the French mathematician Pierre Fermat who is consider as the "Father of modern number theory". The first scientific approach to the study of integers, that is the true origin of the theory of numbers, is generally attribution to the Greeks. Around 600BC Pythagoras and his disciples made rather thorough studies of this integer. A Greek mathematician, Diaphantus of Alexandria was able to solve equations with two or three unknowns. These equations are called Diophantine equation the study of these is known as "Diophantine analysis". The basic problem is representation of an integers n by the quadratic form with the integral values x and y .

A linear Diophantine equation is an equation between two sums of monomial of degree zero (or) one. In 628 AD, Brahmagupta an Indian mathematician gave the first explicit solution of the quadratic equation. The word quadratic is derived from the Latin word quadrates for square. The quadratic equation is a second-order polynomial equation in a single variable x.

There are several different ternary quadratic equations. To comprehend something in more detail is [1-4] visible. For the non-trivial integral answers to the ternary quadratic equation [5-7] has been researched. For numerous ternary quadratic equation [8-10] has been cited. In this article, we investigate another intriguing ternary quadratic equation $3a^2+3r^2-2ar=332n^2$ and obtain several non-trivial integral patterns. A few intriguing connections between the solutions and unique polygons, rhombic, centered and Gnomonic number are displayed.

A. Notations

$T_{m,n}$ = Polygonal number of rank n with size m

RD_n = Rhombic dodecagonal number of rank n

P_n^5 = Pentagonal Pyramidal number of rank n

TO_n = Truncated octahedral number of rank n

P_n^4 = Square Pyramidal number of rank n

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On The Ternary Quadratic Diophantine Equation $x^2 + 14xy + y^2 = z^2$

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***Abstract:** The non-zero unique integer solutions to the quadratic Diophantine equation with three unknowns $x^2 + 14xy + y^2 = z^2$ are examined. We derive integral solutions in four different patterns. A few intriguing relationships between the answers and a few unique polygonal integers are shown.*
***Keywords:** Ternary quadratic equation, integral solutions.*

I. INTRODUCTION

There is a wide range of ternary quadratic equations. One might refer to [1-8] for a thorough review of numerous issues. These findings inspired us to look for an endless number of non-zero integral solutions to another intriguing ternary quadratic problem provided by $x^2 + 14xy + y^2 = z^2$ illustrating a cone for figuring out its many non-zero integral points. A few intriguing connections between the solutions are displayed.

II. CONNECTED WORK

Pr_n = Pronic number of the rank 'n'

Gno_n = Gnomonic number of rank 'n'

$T_{m,n}$ = Polygonal number of rank 'n' with sides 'm'

III. METHODOLOGY

The ternary quadratic Diophantine equation to be solved for its non-zero integral solutions is,

$x^2 + 14xy + y^2 = z^2$ (1) Replacement of linear transformations

$x = \alpha + \beta$ and $y = \alpha - \beta$ (2)

(1) results in

$16\alpha^2 - 12\beta^2 = z^2$ (3)

We present below different patterns of solving (3) and thus obtain different choices of integer solutions of (1)

A. Pattern: I

Assume, $z = z(a,b) = 16a^2 - 12b^2$ (4)

Where a and b are non-zero integers.

Substitute (4) in (3) we get,

$(4\alpha + \sqrt{12}\beta^2)(4\alpha - \sqrt{12}\beta^2) = (4a + \sqrt{12}b)^2(4a - \sqrt{12}b)^2$ (5)

Equating rational and irrational terms we get,

$$\alpha = \frac{1}{4}[16a^2 + 12b^2]$$

$$\beta = 8ab$$

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Construction of Derivation Trees of Plus Weighted Context Free Grammars

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***Abstract:** The core of this paper is to construct Derivation Trees of Plus Weighted Context Free Grammars and the bonding between Plus weighted Context Free grammar and Plus weighted Context Free Dendrosystem is established.*
***Keywords:** Trees and Pseudoterms, Plus Weighted Context Free Dendrolanguage Generating System (P-CFDS), Sets of Derivation Trees of Plus Weighted Context Free Grammars.*

I. INTRODUCTION

Weighted context free grammars and weighted finite automata were initially introduced in significant articles by Marcel-Paul Schutzenberger (1961) and Noam Chomsky (1963), respectively. Weighted automata and their accompanying algorithm are developed by contemporary spoken-dialog or handheld speech recognition systems to express their concepts and promote successful combination and search [1,7].

If there is connection between context-free grammars and grammars of natural languages, it is undoubtedly, as Chomsky proposes, through some stronger concept like that of transformational grammar. In this framework, it is not the context-free language itself that is of interest, but, rather, the set of derivation trees, i.e., the structural descriptions of markers. From the viewpoint of the syntax directed description of fuzzy meanings, sets of trees rather than the sets of strings are of prime importance.

A plus weighted automata [8,9,10,11] is an automata that deals with plus weights up to infinity. Many algebraic structures of plus weighted automata has been discussed in [8,9,10]. Thus we are motivated to study systems to manipulate plus weighted dendrolanguage generating system which is the generalization of fuzzy Context Free Dendrolanguage generating System. Plus weighted Dendrolanguage generating System can also be extended to max weighted automata cited as [2,3,4,5,6]. This work can be further motivated to work in Labeling of trees in graph theory [13,14,15,16,17,18] with plus weights which will give more focus on the paths it prefer.

This paper comprises of 6 sections including this section phase 2 offers some fundamental ideas which are needed for the succeeding section. Section 3 use the records about trees and Pseudoterms. Section 4 offers with Plus Weighted Dendrolanguage Generating System. Section 5 gives the Normal Form of P-CFDS.

II. PRELIMINARIES

In this section we review some basic notations and definitions about grammar and its types.

Definition 2.1

A phrase-structure grammar or grammar is a four tuple $G = \langle V^N, V^N, S, P \rangle$ Where,

V^N is a set of non-terminal symbols, V^T is a set of terminal symbols called alphabets, S is a special element of V^N and is called the starting symbol, P is the production. Relation on

$(V^T V^N)^*$, the set of strings of elements of terminal and non-terminal.

Types of grammars

Type 0 or unrestricted grammar:

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On the Integer Solutions of the Homogeneous Biquadratic Diophantine Equation

$$x^4 - y^4 = 26(z^2 - w^2)p^2$$

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***Abstract:** The homogenous biquadratic Diophantine equation with five unknowns non-zero unique integer solutions $x^4 - y^4 = 26(z^2 - w^2)p^2$ are found using several techniques. The unusual numbers and the solutions are found to have a few intriguing relationships. The relationships between the solutions' recurrences are also shown.*
***Keywords:** Five unknowns in a homogenous biquadratic equation, Numbers in polygons.*

Notations

$T_{12,n}$ = Dodecagonal number of rank n.

$T_{18,n}$ = Octadecagonal number of rank n.

$T_{22,n}$ = Icosidigonal number of rank n.

$T_{26,n}$ = Icosihexagonal number of rank n.

$T_{28,n}$ = Icosioctagonal number of rank n.

Gno_n = Gnomonic number of rank n.

I. INTRODUCTION

The biquadratic equation can be used to represent the quartic equation. These issues can be resolved using the quadratic formula since they can be reduced to quadratic equations [1-5], they are simple to solve. Several mathematicians have developed an interest in biquadratic Diophantine equations, both homogeneous and non-homogeneous. One can refer to [6-11] in the context for a variety of issues involving the two, three, and four variable Diophantine equations.

This communication examines the non-zero unique integer solutions to the biquadratic equation with five unknowns provided by $x^4 - y^4 = 26(z^2 - w^2)p^2$ .Also the recurrence linkages between the solutions are discovered.

II. METHOD OF ANALYSIS

In order to get the non-zero unique integral solution to the homogeneous biquadratic Diophantine problem with five unknowns,

$$x^4 - y^4 = 26(z^2 - w^2)p^2 \quad (1)$$

An explanation of the linear transformation

$$x = u+v, y = u-v, z = 2u+v, w = 2u-v \quad (2)$$

Equation (1) is changed to

$$u^2 + v^2 = 26p^2 \quad (3)$$

A. *Pattern I*

Assume

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Proper Colourings in r-Regular Modified Zagreb Index Graph

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***Abstract:** In this article, the new concept proper colourings in r - regular Modified Zagreb index graph has been introduced. The first and second Modified Zagreb indices are introduced. In this article, new inequalities on chromatic number related with first and second Modified Zagreb indices are being established.*

***Keywords:** Regular graph, Proper Colouring, Modified Zagreb index, Chromatic number.*

I. INTRODUCTION

In this article, we consider only finite, simple and undirected graphs. The symbols V(G) and E(G) denote the vertex set and edge set of a graph G. The cardinality of the vertex set is called the order of G denoted by p. The cardinality of edge set is called the size of G denoted by q edges is called a (p,q) graph. If G is a r-regular graph, then ${}^{m}M_1(G)=\frac{n}{r^2}$ and ${}^{m}M_2(G)=\frac{m}{r^2}$. Proper colourings in r-regular Modified Zagreb index graph is extended by the result proper colourings in magic and anti-magic graphs[17]. Many results and theorems are proved under Modified Zagreb index[1,8,9,10]. This work can be extended to domination which is related with domatic number and Modified Zagreb index[4,5,6]. Further this work can be extended in the field of automata theory [11,12,13,14,15,16,] which has a wide range of application in automata theory. There are many applications in graph labeling under undirected [21,22,23,24,25,26] and directed graph[18,19,20]

II. MAIN RESULTS

A. Definition 2.1

The first and the second Modified Zagreb indices are respectively defined as ${}^{m}M_1(G)=\sum_{v\in V(G)}\frac{1}{(d(v)^2)}$ and ${}^{m}M_2(G)=\sum_{uv\in E(G)}\frac{1}{d(u)d(v)}$, where $d(v)$ is the degree of the vertex V

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A Study on Root Cube Even Mean Labeling for Some Special Graphs

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Abstract: *A graph G = (V,E) with p vertices and q edges is said to be a Root Cube Even Mean Graph if it is possible to label the vertices x ∈ V with distinct elements f(x) from 1,2......q+1 in such a way that when each edge e = uv is labeled with f(e = uv) = $\left\lceil \sqrt{\frac{f(u)^3+f(v)^3}{2}} \right\rceil$ or $\left\lfloor \sqrt{\frac{f(u)^3+f(v)^3}{2}} \right\rfloor$, then the resulting edge labels are distinct. Here f is called a Root Cube Even Mean Labeling of G. In this paper we prove that Quadrilateral snake, Triangular Snake, $P_n \circ K_{1,3}$, Star is a root cube even mean labeling.*

Key Words: Labeling, Root Mean Square Graph, Graceful graph

I. INTRODUCTION

All Graphs in this paper are finite and undirected. The symbols V(G) and E(G) denote the vertex set and edge set of a graph G. The cardinality of the vertex set is called the order of G denoted by p. The cardinality of the edge set is called the size of G denoted by q edges is called a(p,q) graph. A graph labeling is an assignment of integers to the vertices or edges. Bloom and Hsu [2] extended the notion of graceful labeling to directed graphs. Further this work can be extended in the field of automata theory [6,7,8,9,10,11] which has a wide range of application in automata theory. There are many applications in graph labeling under undirected [16,17,18,19,20,21] and directed graph[12,13,14,15]

II. BASIC DEFINITIONS

A. Definition 2.1

The graph $P_n \circ K_{1,3}$ is obtained by attaching complete bipartite graph $K_{1,3}$ to each vertex of path P_n

B. Definition 2.2

The graph is called a Quadrilateral Snake graph which is defined as series connection of non-adjacent vertices of N number of cycle.

C. Definition 2.3

A triangular T_n is obtained from a path $u_1,u_2,u_3,\ldots u_n$ and $v_1,v_2,v_3\ldots v_n$. That is every edge of a path.

III. MAIN RESULTS

A. Theorem 3.1

$P_n \circ K_{1,3}$ is a Root Cube Even Mean Labeling Graph.

Proof

Let $P_n \circ K_{1,3}$ with vertices as $v_1,v_2,\ldots v_n$; $w_1,w_2,\ldots w_n$; $u_1,u_2,\ldots u_n$ and $x_1,x_2,\ldots x_n$

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Intrinsic solutions of Diophantine Equation Involving Centered Square Number

$$E^4 - H^4 = (n^2 + (n-1)^2)(k-l)R^2$$

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Abstract: The bi-quadratic Diophantine equation with five unknown parameters $E^4 - H^4 = (n^2 + (n-1)^2)(k-l)R^2$ ***is researched for its quasi complex arithmetic values. A few correlations between the solutions and plethora of other figures notably the triangular, pronic, stella octagula and gnomonic notation are effectively portrayed.***
Keywords: Bi-quadratic, Non-homogeneous, Integer solution, Diophantine equation, Centered square number.

I. INTRODUCTION

In introductory number theory, a centered square value is a way to portray the guesstimated number of dots together in square which would have perhaps one dot in the centre and every additional dot facing something in preliminary square strands. The range of centers in each centered square multitude is equal to the number of markings on a conventional square pattern with in a particular demographic block altitude of the centre dot. Centered square numbers, like figurate numbers in terms of appearance, have few if any applications in the real world, however they are sporadically studied in entertainment mathematics for their spectacular architectural and mathematically wonderful aspects. While isolated equations have indeed been explored throughout history as a kind of dilemma, the modernization of rigorous conceptions of Diophantine equations is a massive achievement of the twentieth century.[1-3] gives a detailed and self-explanatory study of Diophantine equations. For different techniques towards solving various Diophantine as well as exponential Diophantine equations. [4-19] have been refered. The purpose of research is to delineate non-trivial integral solutions to the five unknowns in the bi-qudratic Diophantine equation facilitated by $E^4 - H^4 = (n^2 + (n-1)^2)(k-l)R^2$. Numerous incredibly interesting correlations between specific solutions and the numbers notably the triangular number, conjointly gnomonic number, pronic number, stella octangula number are proposed.

II. NOTATIONS

1) $Gno_n = (2n-1)$ = Gnomonic number of rank n.
2) $So_n = n(2n^2-1)$ =Stella Octangula number of rank n.
3) $C_{m,n} = 1 + \frac{mn(n-1)}{2}$ =Centered m-goal number of rank n.
4) $CS_n = n^2 + (n-1)^2$ =Centered square number of rank n.
5) $\Pr_n = n(n+1)$ =Pronic number of rank n.
6) $T_{m,n} = n(1 + \frac{(n-1)(m-2)}{2})$ =Triangular number of rank n.
7) $W_n = n2^n - 1$ =Woodall number.
8) $(2^n+1)^2 - 2$ =Kynea number.
9) $M_{Mn} = 2^{2^n-1} - 1$ =Double Mersenne number.

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Integral Solutions of the Ternary Cubic Equation $3(x^2 + y^2) - 4(xy) + 2(x + y + 1) = 522z^3$

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***Abstract:** The non-homogenous cubic equation with three unknowns represented by the Diophantine equation $3(x^2 + y^2) - 4(xy) + 2(x + y + 1) = 522z^3$ is analyzed for its patterns of stringfy integral solutions. A few interesting properties among the solutions and some special polygonal numbers are presented.*
***Keywords:** Cubic equation, integral solutions, polygonal number, square number, special number.*

I. INTRODUCTION

Number theory is a vast and fascinating field of mathematics. Concerned with the properties of numbers in general and integers in particular as well as the wider classes of problems that arises from their study. The study of number theory is very important because of all other branches depends on this branch for their final results.Solving equations in integers is the central problem of Number theory. Number theory may be subdivided into several fields, according to the method use and the type of questions investigated. The term "arithmetic" is also used to refer to Number theory. The word Diophantine refers to the Hellenistic Mathematician of 3rd century, Diophantus of Alexandria who made of such equations and was one of the first Mathematician to introduce symbolism into algebra.In this communication, the non-homogeneous cubic equation with three unknowns represented by the equation $3(x^2 + y^2) - 4(xy) + 2(x + y + 1) = 522z^3$ is considered and in particular a few interesting relations among the solutions are presented.

$T_{m,n}$ = Polygonal number

O_n = Octrahedral number

CS_n = Centered square number

CC_n = Centered cube number

Gno_n = Gnomonic number

SO_n = Stella Octangula number

CH_n = Centered Hexagonal number

TT_n = Truncated tetrahedral number

II. METHOD OF ANALYSIS

The ternary cubic equation to be considered for its quasi integral solution is

$$3(x^2 + y^2) - 4(xy) + 2(x + y + 1) = 522z^3 \quad (1)$$

After using the transformations,

$$x = r + s, y = r - s \quad (2)$$

in (1) leads to $(r + 1)^2 + 5s^2 = 261z^3$ (3)

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Integral Solutions of the Ternion Quadratic Equation

$$a^2 + g^2 = 401s^2$$

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Abstract: In order to find its non zero unique integral solutions for the quadratic diophantine equation with three unknowns given by is analysed. The equation under consideration exhibits multiple patterns of solutions. The solutions are presented with a few fascinating aspects.
Keywords: Quadratic equation with three unknowns, integral solutions, polygonal numbers.

I. INTRODUCTION

The quadratic diophantine equation with three unknowns offers a numerous researching opportunities because of their range[1-3]. For quadratic equations containing three unknowns, one should specially refer [4-19]. This communication deals with yet another fascinating ternary quadratic equation $a^2 + g^2 = 401s^3$ with three unknown factors that can be used to determine any one of an infinite numbers of non-zero integral solutions.

A. Notations

$T_{4,n} = n^2$ (Tetragonal number)

$T_{10,n} = n(4n-3)$ (Decagonal number)

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Solutions of the Transcendental Equations $p^2 - \sqrt[3]{p^5 + q^5 - (pq)^3} + \sqrt[3]{r^2 + s^2} = k^3(n^2+1)$

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Abstract: We make an effort and elucidate the integral solutions of the transcendental equation $p^2 - \sqrt[3]{p^5 + q^5 - (pq)^3} + \sqrt[3]{r^2 + s^2} = k^3(n^2+1)$ under multiple patterns with certain numerical examples.

Keywords: Transcendental Equation, Integral solution, Diophantine equation.

I. INTRODUCTION

A transcendental equation is one with the transcendental functions of the variables that need to be resolved. These equations are solved easily until the variables are roughly known. Numerous equations in which the variables appear to provide an argument for only elementary solutions are used to solve transcendental functions.

We frequently label a function as transcendental when an analytical function cannot be solved by a polynomial equation. It cannot be formulated in terms of a finite sequence of addition, multiplication, and root extraction operations in pure mathematics.

The well-known transcendental functions include the logarithmic, exponential, trigonometric, hyperbolic, and inverse of all of the aforementioned. Some unexpected transcendental functions are included together with specific functions of analysis like elliptic zeta and gamma.

[1-2] has been recommended for fundamental notions and concepts in number theory. For fundamental theories and concepts regarding number theory, [3-5] has been analyzed. For Transcendental equation-related ideas and problems and various methods of solving Diophantine type equations [6-14] were observed.

II. TECHNIQUE FOR ANALYSIS

The equation to be solved is,

$$p^2 - \sqrt[3]{p^5 + q^5 - (pq)^3} + \sqrt[3]{r^2 + s^2} = k^3(n^2+1) \qquad (1)$$

The following linear transformation, $p = (u-v)^2$, $q = (v-u)^2$, $r = u^3 - 3uv^2$, $s = 3u^2v - v^3$ leads to $p^2 - \sqrt[3]{p^5 + q^5 - (pq)^3} + \sqrt[3]{r^2 + s^2} = u^2 + v^2$. Hence, $p^2 - \sqrt[3]{p^5 + q^5 - (pq)^3} + \sqrt[3]{r^2 + s^2} = u^2 + v^2$ reduces to,

$$u^2 + v^2 = k^3(n^2+1) \qquad (2)$$

Now we find various patterns of solutions of (1) using (2).

A. Pattern I

Let $k = y^2 + z^2$, for $y, z \ge 0$

$$u^2 + v^2 = (y^2 + z^2)^3(n^2+1) \qquad (3)$$

Using factorization and equating real and imaginary parts we get,

$$u = n(y^3 - 3yz^2) - (3y^2z - z^3)$$

$$v = (y^3 - 3yz^2) + n(3y^2z - z^3)$$

Therefore, $u = nf(y,z) - g(y,z)$ and $v = f(y,z) + ng(y,z)$

where, $f(y,z) = y^3 - 3yz^2$ and $g(y,z) = 3y^2z - z^3$

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The Notion of new mappings in Minimal Structure

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Abstract— This paper aims forming at the some mappings like m_X-feebly regular open with its complement mapping. These concepts are defined at the m_X-feebly regular continuous function and also discussed at the some related theorems in it.

Keywords— m_X-feebly open, m_X-feebly closed, m_X-feebly interior, m_X-feebly closure, m_X-feebly clopen, m_X-feebly regular open and m_X-feebly regular closed.

I. INTRODUCTION

General topology is the main role of mathematical field. In 1963, Levine introduced at the concepts of semi open set and semi-continuous. The semi open sets, preopen sets, α-open sets, β-open sets, b-open sets and δ-open sets play an important role in the research of generalization of continuity in topological spaces. By using these sets several authors introduced at the various types of Non-continuous functions. Further the analogy in their definitions and properties suggests the need of formulating in the setting of functions. In 1982 Tong., J investigated at the separation axioms and decomposition of continuity. In 1982, S.N Maheswari and P.C. Jain defined and studied at the concepts of feebly open and feebly closed sets in topological spaces. In 2000, the concepts of minimal structure (briefly m_X-structure) was introduced by V. Popa and T. Noiri. They introduced at the notions of m_X-open sets and m_X-closed sets and characterize of those sets using m_X-closure and m_X operators, respectively and also obtained the definitions and characterizations of some mappings by using at the concept of minimal structure.

II. PRELIMINARIES

Definition 2.1: Let (X, τ) be a topological space. A subset A of X is said to be

1) α-open [9] if $A \subset int(cl(int(A)))$
2) Semi-open [6] if $A \subset cl(int(A))$
3) Preopen [9] if $A \subset int(cl(A))$
4) b-open [2] if $A \subset int(cl(A)) \cup cl(int(A))$
5) β-open [1] or semi-preopen if $A \subset cl(int(cl(A)))$
6) Feebly open [7] if $A \subset scl(int(A))$
7) Feebly closed [7] if $int(cl(A)) \subset A$

The family of all α-open (resp., semi-open, preopen, b-open, β-open, feebly open, feebly closed) sets in (X, τ) is denoted by $\alpha(X)$ (resp., $SO(X)$, $PO(X)$, $BO(X)$, $\beta(X)$, $F(X)$).

Definition 2.2 [11, 12]: A subfamily m_X of the power set $P(X)$ of a non-empty set X is called a minimal structure (briefly m-structure) on X if $\varphi \in m_X$ and $X \in m_X$. By (X, m_X) we denote a non-empty set X with a minimal structure m_X on X and call it an m-space. Each member of m_X is said to be m_X-open and the complement of an m_X-open is said to be m_X-closed.

Remark 2.3: Let (X, τ) be a topological space. Then the families τ, $SO(X)$, $PO(X)$, $BO(X)$ and $\beta(X)$ are all m-structure on X.

CRITERION II **STUDENT RESEARCH PUBLICATION**

D. RAGAVI, II M SC MATHEMATICS

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The Notion of new mappings in Minimal Structure

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Abstract— This paper aims forming at the some mappings like m_x-feebly regular open with its complement mapping. These concepts are defined at the m_x-feebly regular continuous function and also discussed at the some related theorems in it.

Keywords— m_x-feebly open, m_x-feebly closed, m_x-feebly interior, m_x-feebly closure, m_x-feebly clopen, m_x-feebly regular open and m_x-feebly regular closed.

I. Introduction

General topology is the main role of mathematical field. In 1963, Levine introduced at the concepts of semi open set and semi-continuous. The semi open sets, preopen sets, α-open sets, β-open sets, b-open sets and δ-open sets play an important role in the research of generalization of continuity in topological spaces. By using these sets several authors introduced at the various types of Non-continuous functions. Further the analogy in their definitions and properties suggests the need of formulating in the setting of functions. In 1982 Tong., J investigated at the separation axioms and decomposition of continuity. In 1982, S.N Maheswari and P.C. Jain defined and studied at the concepts of feebly open and feebly closed sets in topological spaces. In 2000, the concepts of minimal structure (briefly m_x-structure) was introduced by V. Popa and T. Noiri. They introduced at the notions of m_x-open sets and m_x-closed sets and characterize of those sets using m_x-closure and m_x operators, respectively and also obtained the definitions and characterizations of some mappings by using at the concept of minimal structure.

II. Preliminaries

Definition 2.1: Let (X,τ) be a topological space. A subset A of X is said to be

1) α-open [9] if $A \subset int(cl(int(A)))$
2) Semi-open [6] if $A \subset cl(int(A))$
3) Preopen [9] if $A \subset int(cl(A))$
4) b-open [2] if $A \subset int(cl(A)) \cup cl(int(A))$
5) β-open [1] or semi-preopen if $A \subset cl(int(cl(A)))$
6) Feebly open [7] if $A \subset scl(int(A))$
7) Feebly closed [7] if $int(cl(A)) \subset A$

The family of all α-open (resp., semi-open, preopen, b-open, β-open, feebly open, feebly closed) sets in (X,τ) is denoted by $\alpha(X)$ (resp., $SO(X)$, $PO(X)$, $BO(X)$, $\beta(X)$, $FO(X)$).

Definition 2.2 [11, 12]: A subfamily m_x of the power set $P(X)$ of a non-empty set X is called a minimal structure (briefly m-structure) only if $\varphi \in m_x$ and $X \in m_x$. By (X, m_x) we denote a non-empty set X with a minimal structure m_x on X and call it an m-space. Each member of m_x is said to be m_x-open and the complement of an m_x-open is said to be m_x-closed.

Remark 2.3: Let (X,τ) be a topological space. Then the families τ, $SO(X)$, $PO(X)$, $BO(X)$ and $\beta(X)$ are all m-structure on X.

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An Analysis on the Ternary Cubic Diophantine Equation $2(l^2+m^2)-3lm=56t^3$

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***Abstract:** In this article, we concentrate on identifying all the non-zero, infinitely many integral solutions to the ternary cubic equation $2(l^2+m^2)-3lm=56t^3$. Of these solutions, some exciting patterns are discussed.*
***Keywords:** Diophantine equation, Integral Solutions, Ternary Cubic equation withthree unknowns.*

I. INTRODUCTION

The universal language of the world is mathematics, which imparts knowledge of numbers, structures, formulas and shapes. Integers and integral valued functions are studied in the branch of pure mathematics known as Number theory. A polynomial equation with at least two unknowns that has only integer solutions is known as a Diophantine equation. The term "Diophantine" refers to *Diophantus* of Alexandria, a third-century Hellenistic mathematician who studied these equations and was one of the first to introduce symbolismto algebra. Number theory is discussed in [3, 4, 9, 11] whereas in [6] Quadratic Diophantine equation is analysed. In [1, 2, 5, 7, 8, 10], the authors have considered cubic equation for study. In this work, a non homogeneous ternary cubic equation with three unknowns $2(l^2+m^2)-3lm=56t^3$is considered in order to find some of its interesting integral solutions.

A. Notations

1) $SO_n = n(2n^2-1)$ = Stella Octangula number of rank n
2) $Gno_n = 2n-1$ = Gnomonic number of rank n
3) $RD_n = (2n-1)(2n^2-2n+1)$ = Rhombic dodecagonal number of rank n
4) $Star_n = 6n(n-1)+1$ = Star number of rank n
5) $CC_n = (2n-1)(n^2-n+1)$ = Centered cube number of rank n
6) $TT_n = \frac{1}{6}(23n^2-27n+10)$ = Truncted tetrahedral number of rank n
7) $T_{10,n} = n(4n-3)$ = Decagonal number of rank n
8) $TO_n = 16n^3-33n^2+24n-6$ = Truncated octrahedral number of rank n
9) $T_{17,n} = \frac{n(15n-13)}{2}$ = Heptadecagonal number of rank n
10) $T_{3,n} = \frac{n(n+1)}{2}$ = Triangular number of rank n
11) $P_n^7 = \frac{1}{6}n(n+1)(5n-2)$ = Heptagonal pyramidal number of rank n
12) $P_n^5 = \frac{n^2(n+1)}{2}$ = Pentagonal Pyramidal number of rank n
13) $T_{25,n} = \frac{n(23n-21)}{2}$ = Icosipentagonal number of rank n

II. PROBLEM ANALYSIS

Consider the following ternary cubic Diophantine equation for study.

$$2(l^2+m^2)-3lm = 56\,t^3 \qquad (1)$$

Take the linear transformations

$$l = r+s \qquad m = r-s \qquad (2)$$

Applying (2) in (1) leads to the form

$$r^2+7s^2 = 56t^3 \qquad (3)$$

Assume that

$$t = c^2+7d^2 \qquad (4)$$

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SOME NON-EXTENDABLE SPECIAL DIOPHANTINE TRIPLES INVOLVING HEPTAGONAL PYRAMIDAL NUMBERS

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ABSTRACT

In this paper, we look for three specific polynomials with integer coefficients to such an extent that the product of any two numbers added by a non-zero number (or polynomials with integer coefficients) is a perfect square.

KEYWORDS: Special Diophantine triples, heptagonal pyramidal number, Diophantine triples, triples, perfect square, pyramidal number.

NOTATION:

$P_n^7 = \frac{n(n+1)}{6}(5n-2)$: *heptagonal pyramidal number of rank n.*

INTRODUCTION:

A Diophantine equation is a polynomial equation in number theory where only the integer solutions are considered or searched for, typically with two or more unknowns [1-4]. The term "Diophantine" refers to the Greek mathematician Diaphanous of Alexandria, who investigated similar situations and was one of the pioneers in introducing symbolism to variable-based mathematics in the third century.

The problem of the occurrence of Dio triples and quadruples with the property *D(n)* for any integer n as well as for any linear polynomial in *n* was studied by a number of mathematicians [5-8]. In this particular situation, one may turn to [9–16] for a thorough analysis of various difficulties on Diophantine triples. Half companion Diophantine triple sequences were studied in [17]. These results motivated us to examine for Diophantine triples with involving heptagonal pyramidal numbers. This paper aims at constructing special Diophantine triples where the product of any two members of the triple with the addition of a non-zero integer or a polynomial with integer coefficients satisfies the required property. Also, we present three sections where in each of which we find the special Diophantine triples from heptagonal pyramidal number of different ranks with their corresponding properties.

BASIC DEFINITION:

A set of three distinct polynomials with integer coefficients (a_1, a_2, a_3) is said to be Special Diophantine triple with property $D(n)$ if $a_i * a_j + a_i + a_j + n$ is a perfect square for all $1 \le i < j \le 3$, where n may be non zero or polynomial with integer coefficients.

MS.R.JANANI, II M.SC MATHEMATICS

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SPECIAL DIOPHANTINE TRIPLES INVOLVING OCTAGONAL PYRAMIDAL NUMBERS

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ABSTRACT

In this paper, we strive for three particular polynomials with integer coefficients to such an extent that the product of any two numbers added by a non-zero number (or polynomials with integer coefficients) is a perfect square.

KEYWORDS: Triples, Diophantine triples, octagonal pyramidal number, triples, perfect square, pyramidal number.

NOTATION:

$p_n^8 = \frac{n(n+1)}{6}[6n-3]$ = octagonal pyramidal number of rank n

1. INTRODUCTION:

In number theory, a Diophantine equation is a polynomial equation with two or more unknowns that solely considers or searches for integer solutions [1-4]. The term "Diophantine" relates to the Greek mathematician Diophantus of Alexandria who, in the third century, pioneered the introduction of symbolism to variable-based mathematics and studied related problems. Numerous mathematicians have investigated the issue of the occurrence of Dio-triples and quadruples with the property D(n) for any integer n as well as for any linear polynomial in n [5-8]. In this case, [9-16] provides a full study of the many challenges on Diophantine triples. Triple sequences with a half buddy were examined in [17].

Our search for Diophantine triples utilizing octagonal pyramidal numbers was prompted by these findings. This study tries to build Dio-Triples that satisfy the necessary property when the product of any two of the triple's members plus a non-zero integer or a polynomial with integer coefficients is added. The Diophantine triples from octagonal pyramidal numbers of various ranks are also presented in each of the three parts along with the relevant features.

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An Integrated Approach of Ant Colony Optimization (ACO), Machine Learning (ML), and Fuzzy Logic for Revolutionizing Inventory Management in Modern Supply Chains

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Abstract: Objectives: This article presents a groundbreaking approach aimed at addressing the limitations of conventional inventory management practices in contemporary supply chains. The principal objective is to revolutionize inventory management by harnessing the synergistic potential of Ant Colony Optimization (ACO), Machine Learning (ML), and Fuzzy Logic. This integrated framework seeks to elevate demand forecasting, optimize ordering strategies, and enhance inventory control processes. **Methods:** The methodology encompasses the amalgamation of three potent techniques: ACO for the optimization of reorder points and quantities, ML for precise demand forecasting through the analysis of historical data and external variables, and Fuzzy Logic for managing imprecise and linguistic factors to facilitate adaptable decision-making. This fusion minimizes overall inventory costs while refining inventory-related choices. **Findings:** The fusion of ACO, ML, and Fuzzy Logic represents a pragmatic solution for contemporary inventory management. Businesses that embrace this approach can attain adaptability, data-driven precision, and flexibility, resulting in improved demand forecasting, optimized ordering strategies, and more efficient inventory management processes. An illustrative real-world case demonstrates that this integrated approach leads to cost-effective and responsive solutions, with the potential to revolutionize inventory management, translating into cost savings, heightened customer satisfaction, and enhanced operational efficiency. **Novelty:** The novelty of this integrated approach lies in its distinctive amalgamation of ACO, ML, and Fuzzy Logic within the inventory management context. While these techniques are well-established in their own right, their integration signifies an innovative response to an enduring challenge. This approach enables adaptability to shifting conditions, precise demand forecasting, and flexible decision-making, which were arduous to achieve using traditional methodologies.

Keywords: Inventory management, Ant Colony Optimization, Machine Learning, Fuzzy Logic, supply chain, cost control, service levels, operational efficiency, demand forecasting, adaptive inventory decisions, integrated approach.

MS. S. A. MEENA, II M.SC, MATHEMATICS

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Lehmer-4 Mean Labeling of Graphs

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***Abstract:** A graph G=(V,E) with p vertices and q edges is called Lehmer-4 mean graph, if it is possible to label verticesx∈V with distinct label g(x) from 2,4,6,8,………. 2p in such a way thatwhen eachedge e=uv islabeledwithg(e=uv)=* $\left\lfloor \frac{g(u)^4+g(v)^4}{g(u)^3+g(v)^3} \right\rfloor$ *(or)* $\left\lceil \frac{g(u)^4+g(v)^4}{g(u)^3+g(v)^3} \right\rceil$*,then the edge labels are distinct. In this case,g is called Lehmer-4 meanlabelingof G. Inthis paper, Lehmer-4 mean labeling have been introduced.*
***Keywords:** Labeling, Graceful Graph, Multiplicative Labeling*

I. INTRODUCTION

Graph labeling is an assignment of integer to its vertices or edges subject to some certain condition.All Graphs in this paper are considered as finite and undirected. The symbols V(G) and E(G) denote the vertex set and edge set of a graph G. The cardinality of the vertex set is called the order of G denoted by p. The cardinality of the edge set is called the size of G denoted by q edges is called a (p,q) graph. A graph labeling is an assignment of integers to the vertices or edges. Bloom and Hsu[2] extended the notion of graceful labeling to directed graphs. Graceful signed graphs f(uv) is the difference between f(v) and f(v), that is f(uv) = f(v) – f(u). Shalini, Paul Dhayabaran [14] introduced the concept A Study on Root Mean Square Labelings in Graphs. Shalini, Paul Dhayabaran [13] defined An Absolute Differences of Cubic and Square Difference Labeling. Shalini, Gowri, Paul Dhayabaran [15] discussed An Absolute Differences of Cubic and Square Difference LabelingFor Some Families of Graphs. Shalini, Sri Harini, Paul Dhayabaran [19] introduced Sum of an Absolute Differences of Cubic AndSquare Difference Labeling For Cycle Related Graphs. Shalini, Gowri, Paul Dhayabaran [16] studied An Absolute Differences of Cubic and Square Difference Labeling for Some Shadow and Planar Graphs. Shalini, Subha, Paul Dhayabaran [20] investigated A Study on Disconnected Graphs for an Absolute Difference Labeling. Shalini, Subha, Paul Dhayabaran [22] discussed A Study on Disconnected Graphs for Sum of an Absolute Difference of Cubic and Square Difference Labeling. Shalini, Sri Harini, Paul Dhayabaran [21] extended Sum of an Absolute Differences of Cubic And Square Difference Labeling For Path Related Graphs.For detailed survey J.A Gallian survey [1] is referred and for standard terminologies and notations HararyF [2] is referred.

II. BASIC DEFINITIONS

1) *Definition2.1:* A graph G is said to be Lehmer-4 mean graph if it admits lehmer-4 mean labeling.
2) *Definition2.2:* A pathis represented by a walk in which vertices are distinct. A path with n vertices is denoted byP_n
3) *Definition2.3:* The Comb $P_n \odot K_1$ is a graph obtained by joining a single pendant edge to each vertex of a path
4) *Definition2.4:* The graph $P_n \odot K_{1,2}$is obtained by attaching complete bipartite graph $K_{1,2}$ to each vertex of path P_n
5) *Definition2.5:* The graph $P_n \odot K_{1,3}$is obtained by attaching complete bipartite graph $K_{1,3}$ to each vertex of path P_n

III. MAIN RESULTS

A. *Theorem3.1*

The Path P_n is a Lehmer-4 mean graph for $n \geq 2$
Proof:
Let G be a graph of path P_n
The path P_n consists of n vertices and n-1 edges
Define f:V(G) → {2,4,6,8,……,2n} by f $(v_i) = 2i$; $1 \leq i \leq n$
Then the edge labels as f $(e_i) = 2i + 1$; $1 \leq i \leq n$
The edges of the path graph receive distinct numbers
Hence, the pathP_n is a Lehmer-4 mean graph.

S.P.CHITRA , II M.SC, MATHEMATICS

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SOME NON-EXTENDABLE SPECIAL DIOPHANTINE TRIPLES INVOLVING HEPTAGONAL PYRAMIDAL NUMBERS

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ABSTRACT

In this paper, we look for three specific polynomials with integer coefficients to such an extent that the product of any two numbers added by a non-zero number (or polynomials with integer coefficients) is a perfect square.

KEYWORDS: Special Diophantine triples, heptagonal pyramidal number, Diophantine triples, triples, perfect square, pyramidal number.

NOTATION:

$P_n^7 = \frac{n(n+1)}{6}(5n-2)$: *heptagonal pyramidal number of rank n.*

INTRODUCTION:

A Diophantine equation is a polynomial equation in number theory where only the integer solutions are considered or searched for, typically with two or more unknowns [1-4]. The term "Diophantine" refers to the Greek mathematician Diaphanous of Alexandria, who investigated similar situations and was one of the pioneers in introducing symbolism to variable-based mathematics in the third century.

The problem of the occurrence of Dio triples and quadruples with the property $D(n)$ for any integer n as well as for any linear polynomial in n was studied by a number of mathematicians [5-8]. In this particular situation, one may turn to [9–16] for a thorough analysis of various difficulties on Diophantine triples. Half companion Diophantine triple sequences were studied in [17]. These results motivated us to examine for Diophantine triples with involving heptagonal pyramidal numbers. This paper aims at constructing special Diophantine triples where the product of any two members of the triple with the addition of a non-zero integer or a polynomial with integer coefficients satisfies the required property. Also, we present three sections where in each of which we find the special Diophantine triples from heptagonal pyramidal number of different ranks with their corresponding properties.

BASIC DEFINITION:

A set of three distinct polynomials with integer coefficients (a_1, a_2, a_3) is said to be Special Diophantine triple with property $D(n)$ if $a_i * a_j + a_i + a_j + n$ is a perfect square for all $1 \le i < j \le 3$, where n may be non zero or polynomial with integer coefficients.

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Special Diophantine Triples InvolvingSquare Pyramidal Numbers

C.Saranya, B. Achya

***Abstract:** In this communication, we accomplish special Diophantine triples comprising of square pyramidal numbers such that the product of any two members of the set added by their sum and increased by a polynomial with integer coefficient is a perfect square*

***Keywords:** Special Diophantine Triples, Square Pyramidal Number, Perfect Square.*

I. INTRODUCTION

Number theory is fascinating on the grounds that it has such a large number of open problems that seem accessible from the outside. Of course, open problems in number theory are open for a reason. Numbers, despite being simple, have an incredibly rich structure which we only understand to a limited degree. In the mid twentieth century, Thue made an important breakthrough in the study of Diophantine equations. His proof is one of the polynomial methods His proof impacted a great deal of later work in number theory, including Diophantine equations. Various mathematicians considered the problem of the existence of Diophantine triples with the property D(n) for any integer n and besides for any linear polynomial in n [1-5]. Right now, one may suggest for an extensive survey of different issues on Diophantine triples[6-7]. In [8-9], square pyramidal numbers were evaluated using Z-transform and division algorithm. In [10-12], Diophantine triples were discussed. In this paper, we exhibit special Diophantine triples (a, b, c) involving square pyramidal number such that the product of any two elements of the set added by their sum and increased by a polynomial with integerco-efficient is a perfect square.

II. NOTATION

p_n^4 : square pyramidal number of rank n.

III. BASIC DEFINITION

A set of three different polynomials with integer coefficients (a_1, a_2, a_3) is said to be a special Diophantine triple with property D(n) if $a_i * a_j + (a_i + a_j) + n$ is a perfect square for all $1 \leq i < j \leq 3$, where n may be non-zero integer or polynomial with integer coefficients.

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IV. METHOD OF ANALYSIS

A. Construction of the special dio-3 triples involving square pyramidal number of rankn and n − 1

Let $a = 6p_n^4$ and $b = 6p_{n-1}^4$ be square pyramidal numbers of rank n and n − 1 respectively.

Now, $a = 6p_n^4$ and $b = 6p_{n-1}^4$

$$ab + (a + b) + n^4 - 4n + 1$$
$$= 4n^6 - 4n^4 + 4n^3 + n^2 - 2n + 1$$
$$= (2n^3 - n + 1)^2 = \alpha^2$$

(1)

Equation (1) is a perfect square.

$ab + (a + b) + n^4 - 4n + 1 = \alpha^2$ where $\alpha = 2n^3 - n + 1$

Let c be non zero-integer such that,

$ac + (a + c) + n^4 - 4n + 1 = \beta^2$
(2)

$bc + (b + c) + n^4 - 4n + 1 = \gamma^2$
(3)

Solving (2) & (3) $\Rightarrow c(b - a) + (b - a) = b\beta^2 - a\gamma^2$ (4)

(3) -(2) $\Rightarrow \gamma^2 - \beta^2 = c(b - a) + b - a$

Therefore (4) becomes,

$$\gamma^2 - \beta^2 = b\beta^2 - a\gamma^2$$
$$(b + 1)\beta^2 - (a + 1)\gamma^2$$

Setting $\beta = x + (a + 1)y$ and $\gamma = x + (b + 1)y$,

$$\Rightarrow (b + 1)(x + (a + 1)y)^2 - (a + 1)(x + (b + 1)y)^2$$

(5)

Now put $y = 1$,

$$x^2 = (2n^3 - n + 1)^2$$
$$\Rightarrow x = (2n^3 - n + 1)$$

The initial solution of (5) is given by,

$x_0 = (2n^3 - n + 1), y_0 = 1$

Since, $\beta = x + (a + 1)y$ and $\gamma = x + (b + 1)y$, we obtain that,

$\beta = 4n^3 + 3n^2 + 2$

Therefore, the equation (2) becomes,

$$(2) \Rightarrow ac + (a + c) + n^4 - 4n + 1 = \beta^2$$
$$\Rightarrow c(a + 1) + a + n^4 - 4n + 1 = \beta^2$$
$$\Rightarrow c(2n^3 + 3n^2 + n + 1) + (2n^3 + 3n^2 + n) + n^4 - 4n + 1 = \beta^2$$
$$\Rightarrow c(2n^3 + 3n^2 + n + 1) + (2n^3 + 3n^2 + n) + n^4 - 4n + 1$$
$$= (4n^3 + 3n^2 + 2)^2$$
$$\Rightarrow c = 8n^3 + 3$$
$$\Rightarrow c = (2(a + b - 4n + 3))$$

Therefore, the triples

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Dio- Triples Involving Pentagonal Pyramidal Numbers

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Abstract— We scrutinize for three particular polynomials with integer coefficients to such an extent that the result of any two numbers expanded by a non-zero number (or polynomials with number coefficients) is an ideal square.

Keywords— Diophantine triples, Pentagonal Pyramidal number, Polynomials & Perfect square.

I. INTRODUCTION

In Mathematics, a Diophantine equation is a polynomial equation, ordinarily in at least two questions, to such an extent that solitary the whole number arrangements are looked for or examined (a whole number arrangement is an answer to such an extent that all the questions take whole number values).The word Diophantine alludes to the Hellenistic mathematician of the third century, Diophantus of Alexandria, who made an investigation of such conditions and was one of the principal mathematician to bring imagery into variable based math. The numerical investigation of Diophantine issues that Diophantus started is currently called Diophantine analysis. While singular conditions present a sort of confuse and have been considered from the beginning of time, the definition of general hypotheses of Diophantine conditions (past the hypothesis of quadratic structures) was an accomplishment of the twentieth century.

In [1-6], hypothesis of numbers were talked about. In [7-13], Diophantine triples with the property $D(n)$ for any integer n and furthermore for any straight polynomials were talked about and Dio triples for different numbers are constructed. This paper targets developing Dio-Triples where the result of any two individuals from the triple with the expansion of a non-zero whole number or a polynomial with number coefficients fulfils the necessary property. Likewise, we present three segments where in every one of which we discover the Diophantine triples from Pentagonal Pyramidal number of various ranks with their relating properties.

II. RELATED WORK

Notation:

PP_n = Pentagonal Pyramidal number of rank n.

Basic Definition:

A set of positive integers $\{a_1, a_2, \ldots, a_m\}$ is said to have the property $D(n)$ if $a_i a_j + n$ is a perfect square for all $1 \le i < j \le m$; such a set is called a Diophantine m-tuple of size m, where n may be non-zero integer or polynomial with integer coefficients.

III. METHODOLOGY

Section A:

Let $a = 4PP_n$ and $b = 4PP_{n-1}$ be Pentagonal pyramidal numbers of rank n and $n-1$ respectively such that $ab + (n^4 + 2n^3 - n^2 - 2n + 1)$ is a perfect square say X^2.

Let c be any non-zero integer such that

$$ac + (n^4 + 2n^3 - n^2 - 2n + 1) = Y^2 \quad (1)$$

$$bc + (n^4 + 2n^3 - n^2 - 2n + 1) = Z^2 \quad (2)$$

Setting $Y = a + X$ and $Z = b + X$ and subtracting (1) from (2), we get

$$c(b-a) = Z^2 - Y^2 = (Z+Y)(Z-Y)$$
$$= (a + b + 2X)(b - a)$$

Thus, we get $c = a + b + 2X$

Similarly by choosing $Y = a - X$ and $Z = b - X$, we obtain $c = a + b - 2X$

Here we have $X = 2n^3 - n^2 - n + 1$ and thus two values of c are given by $c = 8n^3 - 4n^2 + 2$ and $c = 4n - 2$.

Thus, we observe that

$\{4PP_n, 4PP_{n-1}, 16PP_{n-1} - (36n^2 + 8n + 46)\}$ and

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Integral Solutions of the Ternary Cubic Equation $6(x^2+y^2)-11xy=288z^3$

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Abstract: The Ternary cubic Diophantine Equation represented by $6(x^2+y^2)-11xy=288z^3$ is analyzed for its infinite number of non-zero integral solutions. A few interesting among the solutions are also discussed.
Keywords: Diophantine equation, Integral solutions, cubic equation with three unknowns, Ternary equation.

I. INTRODUCTION

Mathematics is the language of patterns and relationships and is used to describe anything that can be quantified.Diophantine equations have stimulated the interest of various mathematicians. Diophantine equations with higher degree greater than three can be reduced in to equations of degree 2 or 3 and it can be easily solved.In [1-3], theory of numbers is discussed. In [4-5], quadratic Diophantine equations are discussed. In [6-11], cubic, biquadratic and higher order equations are considered for its integral solutions. In this communication the non-homogeneous cubic equation with three unknowns represented by the equation $6(x^2+y^2)-11xy=288z^3$is considered and in particular a few interesting relations among the solutions are presented.

A. Notations

$T_{6,n}=n(2n-1)$ = Hexagonal number of rank n
$T_{8,n}=n(3n-2)$ = Octagonal number of rank n
$T_{10,n}=n(4n-3)$ = Decagonal number of rank n
$T_{12,n}=n(5n-4)$ = Dodecagonal number of rank n
$T_{14,n}=n(6n-5)$ = Tetradecagonal number of rank n
$T_{16,n}=n(7n-6)$ = Hexadecagonal number of rank n
$T_{18,n}=n(8n-7)$ = Octadecagonal number of rank n
$T_{20,n}=n(9n-8)$ = Icosagonal number of rank n
$T_{22,n}=n(10n-9)$ = Icosidigonal number of rank n
$T_{24,n}=n(11n-10)$ = Icositetragonal number of rank n
$T_{26,n}=n(12n-11)$ = Icosihexagonal number of rank n
$T_{28,n}=n(13n-12)$ = Icosioctagonal number of rank n
$T_{30,n}=n(14n-13)$ = Triacontagonal number of rank n
$T_{m,n}=n\left[1+\frac{(n-1)(m-2)}{2}\right]$ = polygonal number of rank n
$O_n=\frac{1}{3}(2n^3+n)$ = Octahedral number of rank n
$Gno_n=(2n-1)$ =Gnomonic number of rank n
$P_n^m=\frac{n(n+1)}{6}[(m-2)n+(5-n)]$ =Pyramidal number of rank n

II. METHOD OF ANALYSIS

The ternary cubic Diophantine equation to be solved for its non-zero integral solutions is

$$6(x^2+y^2)-11xy=288z^3 \quad (1)$$

The substitution of linear transformations

Let $x=u+v$ and $y=u-v$ (2)

In (1) leads to,

$$u^2+23v^2=288z^3 \quad (3)$$

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DIOPHANTINE TRIPLES INVOLVING SQUARE PYRAMIDAL NUMBERS

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Abstract

In this paper, we scan for three particular polynomials with whole number coefficients to such an extent that the result of any two numbers expanded by a non-zero number (or polynomials with number coefficients) is an ideal square.

Introduction

In mathematics, a Diophantine condition is a polynomial condition, conventionally in at any rate two inquiries, so much that lone the entire number game plans are searched for or analyzed (an entire number course of action is a response so much that all the inquiries take entire number values). The word Diophantine suggests the Greek mathematician of the third century, Diophantus of Alexandria, who made an examination of such conditions and was one of the foremost mathematicians to bring symbolism into variable based math. The mathematical examination of Diophantine issues that Diophantus began is as of now called Diophantine analysis. While particular conditions present such a confound and have been considered from the start of time, the meaning of general speculations of Diophantine conditions (past the theory of quadratic constructions) was an achievement of

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OBSERVATIONS ON TERNARY QUADRATIC EQUATION $3x^2 + 2y^2 = 275z^2$

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Abstract

The Ternary Quadratic Diophantine Equation $3x^2 + 2y^2 = 275z^2$ is analyzed for its infinite number of non-zero integral solutions.

Introduction

Diophantine equations have stimulated the interest of various mathematicians. Diophantine equations with higher degree greater than three can be reduced into equations of degree 2 or 3 and it can be easily solved. In [1-3], theory of numbers is discussed. In [4-5], quadratic Diophantine equations are discussed. In [6-11], cubic, biquadratic and higher order equations are considered for its integral solutions.

This communication concerns with yet another interesting ternary quadratic equation $3x^2 + 2y^2 = 275z^2$ representing a cone for determining its infinitely many non-zero integral points. Also, a few interesting relations among the solutions are presented.

2020 Mathematics Subject Classification: 11Dxx.
Keywords: Diophantine equation, Integral solutions, Quadratic equation with three unknowns, Ternary equation.
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MS.B.ACHYA, II M.SC, MATHEMATICS

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Special Dio 3-Tuples Involving Square Pyramidal Numbers

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***Abstract:** In this communication, we accomplish special dio 3-tuples comprising of square pyramidal numbers such that the product of any two members of the set subtracted by their sum and increased by a polynomial with integer coefficients is a perfect square.*
***Keywords:** Special dio 3-tuples, Pyramidal number, perfect square, square pyramidal number.*

NOTATION: P_n^4: square pyramidal number of rank n.

I. INTRODUCTION

In Mathematics, a Diophantine equation is a polynomial equation, ordinarily in at least two questions, to such an extent that solitary the whole number arrangements are looked for or examined (a whole number arrangement is an answer to such an extent that all the questions take whole number values).The word Diophantine alludes to the Hellenistic mathematician of the third century, Diophantus of Alexandria, who made an investigation of such conditions and was one of the principal mathematician to bring imagery into variable based math. The numerical investigation of Diophantine issues that Diophantus started is currently called Diophantine analysis. While singular conditions present a sort of confuse and have been considered from the beginning of time, the definition of general hypotheses of Diophantine conditions (past the hypothesis of quadratic structures) was an accomplishment of the twentieth century.

In [1-5], hypothesis of numbers were talked about. In [6-14], Diophantine triples with the property $D(n)$ for any integer n and furthermore for any straight polynomials were talked about and Dio triples for different numbers are constructed. In this paper, we exhibit special dio 3-tuples (a, b, c) involving square pyramidal number such that the product of any two elements of the set subtracted by their sum and increased by a polynomial with integer coefficients is a perfect square.

II. BASIC DEFINITION

A set of three different polynomials with integer coefficients (a_1, a_2, a_3) is said to be a special dio 3-tuple with property D(n) if $a_i * a_j - (a_i + a_j) + n$ is a perfect square for all $1 \le i < j \le 3$, where n may be non-zero integer or polynomial with integer coefficients.

III. METHOD OF ANALYSIS

A. Section-A

Construction of the special dio-3 tuples involving square pyramidal number of rank n and $n-1$:

Let $a = 6P_n^4$ and $b = 6P_{n-1}^4$ be square pyramidal numbers of rank n and $n-1$ respectively, such that

$$ab - (a + b) + n^4 + 4n + 1 = \alpha^2 \quad (1)$$

Equation (1) is a perfect square, where $\alpha = 2n^3 - n - 1$

Let c be non zero-integer such that,

$$ac - (a + c) + n^4 + 4n + 1 = \beta^2 \quad (2)$$

$$bc - (b + c) + n^4 + 4n + 1 = \gamma^2 \quad (3)$$

MS.T.VENNILA, II M.SC, MATHEMATICS

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Observations on the Ternary Quadratic Diophantine Equation $9(x^2 + y^2)-17xy+4x+4y+16=84z^2$

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Abstract— The Ternary Quadratic Diophantine Equation representing non-homogeneous cone is analyzed for its non-zero distinct integer points on it. Six different patterns of integral solutions satisfying the cone under consideration are obtained. A few interesting relations between the solutions and some special number patterns are presented.

Keywords— Ternary non-homogeneous Quadratic, Diophantine equation, integral solutions.

I. INTRODUCTION

Ternary quadratic equations are rich in variety. For an extensive review of various problems one may refer [1-7]. In [8], the ternary quadratic Diophantine equation of the form $kxy + m(x+y) = z^2$ has been studied for non-trivial integral solutions. In [9–15], the various Diophantine equations are studied for their non-zero integral solutions. These results have motivated us to search for infinitely many non-zero integral solutions of another interesting ternary quadratic equation given by $9(x^2+y^2)-17xy+4x+4y+16=84z^2$ representing a cone for determining its infinitely many non-zero integral points. Also, a few interesting relations among the solutions are presented.

II. RELATED WORK

Pr_n = Pronic number of rank 'n'.

$T_{m,n}$ = Polygonal number of rank 'n' with sides 'm'.

$4DF_n$ = Four Dimensional Figurate number of rank 'n'.

CS_n = Centered Square number of rank 'n'.

Gno_n = number Gnomonic of rank 'n'.

$Star_n$ = Star number of rank 'n'.

III. METHODOLOGY

The ternary quadratic Diophantine equation to be solved for its non-zero integral solutions is

$$9(x^2+y^2)-17xy+4x+4y+16=84z^2 \quad (1)$$

The substitution of linear transformations

$$x = u+v \quad \text{and} \quad y = u-v \quad (2)$$

in (1) leads to, $(u+4)^2+35v^2=84z^2$ (3)

We illustrate below six different patterns of non-zero distinct integer solutions to (1).

PATTERN:1

Assume $z = z(a,b) = a^2+35b^2$ (4)

where a and b are non-zero integers.

and write $84 = (7+i\sqrt{35})(7-i\sqrt{35})$ (5)

Using (4) and (5) in (3), and using factorization method,

$$\left((u+4)+i\sqrt{35}v\right)\left((u+4)-i\sqrt{35}v\right) = (7+i\sqrt{35})(7-i\sqrt{35})\left[\left(a+i\sqrt{35}b\right)^2\left(a-i\sqrt{35}b\right)^2\right] \quad (6)$$

Equating the like terms and comparing real and imaginary parts, we get

$$u = u(a,b) = 7a^2-245b^2-70ab-4$$

$$v = v(a,b) = a^2-35b^2+14ab$$

Substituting the above values of u and v in equation (2), the corresponding integer solutions of (1) are given by

$$x = x(a,b) = 8a^2-280b^2-56ab-4$$

$$y = y(a,b) = 6a^2-210b^2-84ab-4$$

$$z = z(a,b) = a^2+35b^2$$

OBSERVATIONS:

1. $x(a,a)-y(a,a)+4z(a,a)-52T_{4,a}-26Gno_a \equiv 0 \pmod{26}$.
2. $9\left(y(a,a)-x(a,a)\right)+6z(a,a)$ is a perfect square.
3. $y(a,a)-x(a,a)+z(a,a)-38T_{4,a} \equiv 0 \pmod{38}$.
4. $y(a,a)-x(a,a)+z(a,a)-38T_{4,a}-19Gno_a \equiv 0 \pmod{19}$.
5. Each of the following expressions represents a Nasty number.

(i) $6z(a,a)$

KEERTHIKA M, II M.SC, MATHEMATICS

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Ecosystem for Fostering Innovation: Case of Digital Business Models and Digital Platforms

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ABSTRACT

Ecosystems are gaining ever increasing importance in digital business environments. New digital business models implemented using digital platforms heavily rely on ecosystem network. Thus, it is worthwhile investigating what role ecosystems play in the process of the digital transformation of companies. This chapter provides a theoretical background of the ecosystem research concerning digital trends, such as digital transformation, digital platforms and digital service innovation. To deeper understand how ecosystem postulates are applied in companies, case study finding from two companies operating in the service and manufacturing sector are presented. Moreover, the ecosystem role is observed in selected in both in the process of innovation generation (value creation), as well as in the implemented digital business model (value capture).

INTRODUCTION

During the last decade, massive improvements in information reach, computing, communication, and connectivity, have made digital technologies key emerging technologies that can fundamentally impactthe business environment, which includes the impact on services, processes, business models and whole industries. In a very short time, the term digital became very popular. It changed the usual vocabulary of information science from information technology (IT) to digital technologies; from IT strategy to digital strategy, also introducing what we now call digital disruption and digital economy. Another notable change of course happened in technological governance in organizations (Spremic, 2017). From mainly internally oriented IT governance mode, organizations shifted to an externally focused use of digital technologies. On the one hand, the IT initiatives have become more internally focused, mainly intending to align with the current business process. Digital technologies, on the other hand, have become externally oriented, thus enabling digital services proliferation and enhancement of customer experience. These changes of organizational focus came along with disrupting the current business model, changing the organizational culture and affecting the entire business ecosystem (Ivan?i?, Vuksic, & Sprermic, 2019).

R.ABARNA, II M.SC, MATHEMATICS

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OPTIMIZATION OF OPTIMAL ORDERING STRATEGY PRICING MODEL OF FUZZY TOTAL COST IN DEGRADED MATERIALS

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ABSTRACT

In the Paper we discuss optimal ordering strategy in inventory model with degenerate material in Fuzzy with the help of ranking method. The minimization of total cost for a economic production quantity (EOQ) inventory model. A inventory cost model is developed in this input method. The optimal policy of the fuzzy production inventory model is determined using the algorithm extension of a Kuhn-Tucker Method for solving inequality, in integration method the fuzzy total cost in optimal strategy. A numerical example is used to show the best comparison between the integration Fuzzy Models.

KEYWORDS: Fuzzy inventory, Total cost, Kuhn-Tucker Method, Deffuzzifying, Graded mean integration.

INTRODUCTION

In 2007, the concept of Minimizing the Economic lot size of a three-stage supply chain are introduced by C.J.Chung, H.M.Wee. In 1990, the concept of Economic ordering policies during special discount periods for dynamic inventory problems are developed by S.K.Goyal. In Kalaiarasi K., Sumathi M .,Sabina begum M., [9] analyzed Optimization of fuzzy inventory model for Economic Order Quantity using Lagragian method. In Kalaiarasi K., Sumathi M., And Daisy S., [10] developed the Fuzzy Economic Order Quantity Inventory Model Using Lagrangian method.

In Section 2, represents graded mean integration and some arithmetic operations . In Section 3, inventory for crisp model and fuzzy model are presented. Numerical example is given to test the proposed model and Sensitivity analysis has been made for different changes in the parameter values in section 4, finally conclusion have been made in section 5.

THE FUZZY ARITHMETICAL OPERATIONS UNDER FUNCTION PRINCIPLE

Function principle is suggested to be as the fuzzy arithmetical operations by trapezoidal fuzzy numbers. We define some fuzzy arithmetical operations under Function Principle as follows.

Suppose $\tilde{X} = (x_1, x_2, x_3, x_4)$ & $\tilde{Y} = (y_1, y_2, y_3, y_4)$ are 2 trapezoidal fuzzy numbers. Then

(1) The addition of $\tilde{X}$ and $\tilde{Y}$ is

$$\tilde{X} \oplus \tilde{Y} = (x_1 + y_1, x_2 + y_2, x_3 + y_3, x_4 + y_4)$$

Where $x_1, x_2, x_3, x_4, y_1, y_2, y_3, y_4$ are any real numbers.

(2) The multiplication of $\tilde{X}$ and $\tilde{Y}$ is

$$\tilde{X} \otimes \tilde{Y} = (Z_1, Z_2, Z_3, Z_4)$$

Where $T = \{x_1 y_1, x_2 y_2, x_3 y_3, x_4 y_4\}$

$T_1 = \{x_2 y_2, x_2 y_3, x_3 y_2, x_3 y_3\}$

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R.SOWMIYA, II M.SC, MATHEMATICS

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OPTIMATION OF EOQ INVENTORY MODEL WITH INFERIOR WORTH PRODUCTS IN EXPECTED PROFIT PER CYCLE AND TIME

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ABSTRACT

This research calculates the minimization of the cost for a steady Economic order quantity under the fuzzy arithmetical operations of function. The fuzzy model is extended where the demand rate, fixed ordering cost, holding cost are fuzzy pentagonal numbers. The optimal policy for the fuzzy manufacture inventory model is determined using the algorithm of Kuhn-tucker method for solving inequality constraints and graded mean integration for the fuzzy total cost. Thus, a numerical example is sloved to obtain for used to view the integration models.

KEYWORDS: EOQ inventory, Total cost, Fuzzification, Defuzzification, Graded Mean Integration, Pentagonal number.

1. INTRODUCTION

In 1965 the concept of fuzzy sets was introduced by Lofti A.Zadeh . In 1970 L.A Zadeh and R.E.Bellman were introduced fuzzy set theory in decision making process. The Economic Order Quantity (EOQ) model was developed by Ford W.Harris in 1913.Kalaiarasi[10] analyzed Optimization of fuzzy inventory model for Economic order quantity using Lagragean method. Kalaiarasi[11] developed the Fuzzy Economic Order quantity Inventory Model .

This Paper we calculates the minimization of the total cost. An inventory model considering holding cost, ordering cost and total demand rate are all in terms of pentagonal fuzzy numbers. The arithmetic operations are defined and applied the fuzzy total cost and an extension of the Kuhn Tucker method by using to solve inequality constraints and to find optimal fuzzy Economic Order Quantity of each fuzzy inventory model. Graded mean integration is used for defuzzifying the annual integrated total cost.The numerical example illustrates the solution procedure demonstrating that the developed model.

2. THE FUZZY ARITHMETIC OPERATIONS UNDER FUNCTION PRINCIPLE

Function principle is introduced to be as the fuzzy arithmetic operations by pentagonal fuzzy numbers .we define some arithmetic operations under function principle as follows:

Suppose $\tilde{F}=(f_1, f_2, f_3, f_4)$ & $\tilde{G}=(g_1, g_2, g_3, g_4)$are two trapezoidal fuzzy numbers.Then

(1) The Addition of $\tilde{F}$ and $\tilde{G}$ is

$$\tilde{F} \oplus \tilde{G}=(f_1+g_1, f_2+g_2, f_3+g_3, f_4+g_4)$$

Where $f_1, f_2, f_3, f_4, g_1, g_2, g_3$ and g_4 are any real numbers.

(2) The multiplication of $\tilde{F}$ and $\tilde{G}$ is

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$$\tilde{F} \otimes \tilde{G}=(H_1, H_2, H_3, H_4)$$

Where $W=(f_1g_1, f_2g_2, f_3g_3, f_4g_4)$

$$W_1=(f_2g_2, f_2g_3, f_3g_2, f_3g_3)$$

L.DUTCHADHINI, S.RUBITHA II M.SC, MATHEMATICS

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Inter Relationship of The Mappings with Separation Axioms in Minimal Structure

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***Abstract*— In this paper, we analyse and study at the class of some sets and also related their functions. Furthermore, some of their equivalent conditions among them are analysed with the separation axioms.**

***Keywords*— m_x-feebly open, m_x-feebly closed, m_x-feebly interior, m_x-feebly closure, m_x-feebly clopen, m_x-feebly clopen-T_1 and m_x-feebly clopen-T_2.**

I Introduction

General topology is the main role of mathematical field. In 1963, Levine introduced at the concepts of semi open set and semi-continuous. The semi open sets, preopen sets, α-open sets, β-open sets, b-open sets and δ-open sets play an important role in the research of generalization of continuity in topological spaces. By using these sets several authors introduced at the various types of Non-continuous functions. Further the analogy in their definitions and properties suggests the need of formulating in the setting of functions. In 1982 Tong., J investigated at the separation axioms and decomposition of continuity. In 1982, S.N Maheswari and P.C. Jain defined and studied at the concepts of feebly open and feebly closed sets in topological spaces. In 2000, the concepts of minimal structure (briefly m_X-structure) was introduced by V. Popa and T. Noiri. They introduced at the notions of m_X-open sets and m_X-closed sets and characterize of those sets using m_X-closure and $m_X$operators, respectively and also obtained the definitions and characterizations of separation axioms by using the concept of minimal structure.

II Preliminaries

Definition 2.1: Let (X, τ) be a topological space. A subset A of X is said to be

1) α-open [8] if $A \subset$ int (cl (int (A)))
2) Semi-open [5] if $A \subset$ cl (int (A))
3) Preopen [8] if $A \subset$ int (cl (A))
4) b-open [2] if $A \subset$ int (cl (A)) $\cup$ cl (int (A))
5) β-open [1] or semi-preopen if $A \subset$ cl (int (cl (A)))
6) Feebly open if $A \subset_s$ cl (int (A))
7) Feebly closed if int (cl (A)) $\subset A$

The family of all α-open (resp., semi-open, preopen, b-open, β-open, feebly open, feebly closed) sets in (X, τ) is denoted by $\alpha(X)$ (resp., $SO(X), PO(X), BO(X), \beta(X), FO(X)$).

L.DUTCHANDHINI, II M.SC, MATHEMATICS

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RESEARCH ARTICLE OPEN ACCESS

A Study on Connectedness in the Digital Topology Via Graph Theory

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Abstract:
In this paper we define at the two operators at Cartesian complex in digital topology based on graph theory and also investigate at the new classes of separation, connectedness and disconnectedness among the pixels with the topological axioms in digital plane. The related theorems are proved based on these concepts.

Keywords — **Cut point, pixels, interior operator, closure operator, separation, connectedness, disconnectedness.**

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I. Introduction

Digital topology is to study at the topological properties of digital, image arrays. The Cartesian complex have the collection of the pixel. In this case one can specify at the pixels on the simple closed curves which states that simple closed curves separate at the plane into two connected sets. When a pixel is extended to be such a set of pixels possess connectivity and is called a region. The use of digital topological ideas to explore various aspects of graph theory. A graph (resp., directed graph or digraph) (R.J. Wilson, 1996), G=(V(G), E(G)) consists of a vertex set V(G) and an edge set E(G) of unordered (resp., ordered) pairs of elements of V(G). To avoid ambiguities, we assume that the vertex and edge sets are disjoint. A subgraph (W.D. Wallis, 2007), of a graph G is a graph, each of whose vertices belong to V(G) and each of whose edges belong to E(G). A walk in which no vertex appears more than once is called a path. For other notions or notations in topology not defined here we follow closely (R. Englking, 1989; S. Willard, 1970).

II. Preliminaries

Definition 2.1[1]: A point x in X is called a cut point (respectively endpoint) if X-{x} has two (one) components. (In the literature our cut-point is usually called a strong cut-point, but here it turns out that these two notions coincide.) The parts of X-{x} are its components if there are two, and X-{x}, φ if there is only one.

Definition 2.2[5]: A nonempty set S is called a locally finite (LF) space if to each element e of S certain subsets of S are assigned as neighbourhoods of e and some of them are finite.

Definition 2.3 [5]: Axiom 1. For each space element e of the space S there are certain subsets containing e, which are neighbourhoods of e. The intersection of two neighbourhoods of eis again a neighbourhood of e. Since the space is locally finite, there exists the smallest neighbourhood of e that is the intersection of all neighbourhoods of e. Thus, each neighbourhood of e contains its smallest neighbourhood. We shall denote the smallest neighbourhood of e by SN(e).

Definition 2.4[5]: Axiom 2. There are space elements, which have in their SN more than one element.

Definition 2.5[5]: If b ∈ SN(a) or a ∈ SN(b), then the elements a and b are called incident to each other.

Definition 2.6[4]: A path is a sequence $(p_i / 0 \leq i \leq n)$, and p_i is adjacent to p_{i+1}. In another way Let Tbe a subset of the space S. In another way [5] a sequence $(a_1, a_2, \ldots, a_k)$, $a_i \in T$, i= 1, 2, . . ., k; in which each two subsequent elements are incident to each other, is called an incidence path in T from a_1 to a_k.

Definition 2.7 [4]: A set of pixels is said to be connected if there is a path between any two pixels.

Remark 2.8[5]: In another way A subset T of the space S is connected iff for any two elements of T there exists an incidence path containing these two elements, which completely lies in T

Definition 2.9 [5]: The topological boundary, also called the frontier, of a non-empty subset T of the space S is the set of all elements e of S, such that each neighbourhood of e contains elements of both T and its complement S–T. It is denoted by the frontier of T ⊆S by Fr (T, S).

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Analyzation About Some New Type of m_x-Open Sets with its Related Mappings

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Abstract— **In this paper, we extend at the study of inter relationship of the mappings with separation axioms in minimal structure and introduce m_x-feebly regular interior point, m_x-feebly exterior point and m_x—feebly regular frontier point with its related mappings based on some new type of m_x-open sets.**

Keywords— **m_x-feebly open, m_x-feebly closed, m_x-feebly interior, m_x-feebly closure, m_x-feebly clopen, m_x-feebly clopen-T_1 and m_x-feebly clopen-T_2.**

I Introduction

General topology is the main role of mathematical field. In 1963, Levine introduced at the concepts of semi open set and semi-continuous. The semi open sets, preopen sets, α-open sets, β-open sets, b-open sets and δ-open sets play an important role in the research of generalization of continuity in topological spaces. By using these sets several authors introduced at the various types of Non-continuous functions. Further the analogy in their definitions and properties suggests the need of formulating in the setting of functions. In 1982 Tong., J investigated at the separation axioms and decomposition of continuity. In 1982, S.N Maheswari and P.C. Jain defined and studied at the concepts of feebly open and feebly closed sets in topological spaces. In 2000, the concepts of minimal structure (briefly m_X-structure) was introduced by V. Popa and T. Noiri. They introduced at the notions of m_X-open sets and m_X-closed sets and characterize of those sets using m_X-closure and $m_X$operators, respectively and also obtained the definitions and characterizations of separation axioms by using the concept of minimal structure.

II Preliminaries

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4) b-open [2] if $A \subset \text{int}(\text{cl}(A)) \cup \text{cl}(\text{int}(A))$
5) β-open [1] or semi-preopen if $A \subset \text{cl}(\text{int}(\text{cl}(A)))$
6) Feebly open [7] if $A \subset_s \text{cl}(\text{int}(A))$
7) Feebly closed [7] if $\text{int}(\text{cl}(A)) \subset A$

The family of all α-open (resp., semi-open, preopen, b-open, β-open, feebly open, feebly closed) sets in (X, τ) is denoted by $\alpha(X)$ (resp., $SO(X), PO(X), BO(X), \beta(X), FO(X)$).

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GENERALIZATION OF PRODUCT DIGITAL TOPOLOGY WITH THE MAPPING AMONG THE PIXELS

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Abstract- In this paper the continuous functions based on frontier and also smallest neighborhood system is defined among the pixels at the product digital topology with the axioms C_1, C_2, C_3 in the cartesian complex and also generalized at these concepts, related theorems are proved.

Keywords-cut point, classical axioms of the topological space, incidence, path, opponent, frontier, locally finite space, smallest neighbourhood, interior, closure.

1. Introduction

Digital topology is to study at the topological properties of digital image arrays. These properties on cathode ray tubes are virtually important in a wide range of diverse applications, including computer graphics, computer tomography, pattern analysis and robotic design. A topological framework contains many pixels or 2-cell. A digital picture can be stored at them. These framework settings are in some of the devices for the focus purpose. In this case one can specify at the pixels on the simple closed curves which states that a simple closed curve separates at the plane into two connected sets. When a pixel is extended to be such a set of pixels possess connectivity and is called a region.

2. Preliminaries

Definition 2.1[2]: A point x in X is called a cut point (respectively endpoint) if X-{x} has two (one) components. (In the literature our cut-point is usually called a strong cut-point, but here it turns out that these two notions coincide.) The parts of X-{x} are its components if there are two, and X-{x}, φ if there is only one.

Definition 2.2[5]: A nonempty set S is called a locally finite (LF) space if to each element e of S certain subsets of S are assigned as neighborhoods of e and some of them are finite.

Definition 2.3 [5]: Axiom 1. For each space element e of the space S there are certain subsets containing e, which are neighborhoods of e. The intersection of two neighborhoods of e is again a neighborhood of e. Since the space is locally finite, there exists the smallest neighborhood of e that is the intersection of all neighborhoods of e. Thus, each neighborhood of e contains its smallest neighborhood. We shall denote the smallest neighborhood of e by SN(e).

Definition 2.4[5]: Axiom 2. There are space elements, which have in their SN more than one element.

Definition 2.5[5]: If $b \in SN(a)$ or $a \in SN(b)$, then the elements a and b are called incident to each other.

Definition 2.6[4]: A path is a sequence $(p_i / 0 \leq i \leq n)$, and p_i is adjacent to p_{i+1}. In another way Let T be a subset of the space S. In another way [4] a sequence $(a_1, a_2, \ldots, a_k)$, $a_i, \in T$, $i = 1, 2, \ldots, k$; in which each two subsequent elements are incident to each other, is called an incidence path in T from a_1 to a_k.

Definition 2.7 [4]: A set of pixels is said to be connected if there is a path between any two pixels.

Remark 2.8[5]: In another way A subset T of the space S is connected iff for any two elements of T there exists an incidence path containing these two elements, which completely lies in T

Definition 2.9 [5]: The topological boundary, also called the frontier, of a non-empty subset T of the space S is the set of all elements e of S, such that each neighborhood of e contains elements of both T and its complement S−T. It is denoted by the frontier of $T \subseteq S$ by Fr (T, S).

Definition 2.10[5]: A subset $O \subset S$ is called open in S if it contains no elements of its frontier Fr (O, S). A subset $C \subset S$ is called closed in S if it contains all elements of Fr (C, S).

Definition 2.11[5]: The neighbourhood relation N is a binary relation in the set of the elements of the space S. The ordered pair (a, b) is in N iff $a \in SN(b)$. We also write aNb for (a, b) in N.

A.SUDAR, II M.SC, MATHEMATICS

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MINIMIZATION OF MULTIPLICATIVE LABELING FOR SOME FAMILIES OF GRAPHS

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ABSTRACT

In this paper, we discuss minimization of multiplicative labeling for some families of Graphs. A function f is called a minimization of multiplicative labeling of a graph G with q edges, if f is a bijective function from the vertices of G to the set $\{1,2,3,......p\}$ such that when each edge uv is assigned the label $f(uv) = f(u) * f(v) - \min\{f(u), f(v)\}$, then the resulting edge labels are distinct numbers. We investigated some families of graphs such as slingshot, stair, stethoscope, spectacles which admits minimization of multiplicative labeling.

KEYWORDS: Graph labeling, Multiplicative graph labeling, Graceful labeling.

1.1 INTRODUCTION

The field of mathematics plays a very important role in different fields of Science and Engineering. One of the most important areas in mathematics is graph theory. In graph theory, one of the main concepts is graph labeling. A graph can be labeled or unlabeled. Labeled graph are used to identification. Labeling can be used not only to identify vertices or edges, but also to signify some additional properties depending on the particular labeling. Graph labeling is an assignment of integer, to its vertices or edges subject to some certain conditions.

All graphs in this paper are finite and undirected. The symbols V (G) and E (G) denotes the vertex set and edge set of a graph G. A dynamic survey on graph labeling is regularly updated by Gallian [3] and it is published by Electronic journal of combinatories. Some basic concepts are taken from Frank Harary [4]. Shalini and Paul Dhayabaran [9] introduced the concept of minimization of multiplicative labeling. In this paper, we investigated some families of graphs such as slingshot, stair, stethoscope, spectacles which admits minimization of multiplicative labeling.

Definition 1.1

Let G = (V (G), E (G)) be a graph. A graph G is said to be minimization of multiplicative labeling if there exists a bijective function $f : V(G) \to \{1,2,3,......p\}$ such that, when each edge uv is assigned the label $f(uv) = f(u) * f(v) - \min\{f(u), f(v)\}$, then the resulting edge labels are distinct numbers.

Definition 1.2

A graph G is said to be minimization of multiplicative graph if it admits a minimization of multiplicative labeling.

2.1 Main Results

Theorem 2.1

The Slingshot $Slgt_n$ is a minimization of multiplicative graph.

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A STUDY ON MINIMIZATION OF MULTIPLICATIVE LABELING FOR SOME SPECIAL GRAPHS

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ABSTRACT

In this paper, we discuss minimization of multiplicative labeling for some special Graphs. A function f is called a minimization of multiplicative labeling of a graph G with q edges, if f is a bijective function from the vertices of G to the set $\{1,2,3,\ldots\ldots p\}$ such that when each edge uv is assigned the label $f(uv) = f(u) * f(v) - \min\{f(u), f(v)\}$, then the resulting edge labels are distinct numbers. We investigated some special graphs such as Ladder, The Shrine, Window which admits minimization of multiplicative labeling.

KEYWORDS: Graph labeling, Multiplicative graph labeling, Graceful labeling.

1.1 INTRODUCTION

The field of mathematics plays a very important role in different fields of Science and Engineering. One of the most important areas in mathematics is graph theory. In graph theory, one of the main concepts is graph labeling. A graph can be labeled or unlabeled. Labeled graph are used to identification. Labeling can be used not only to identify vertices or edges, but also to signify some additional properties depending on the particular labeling. Graph labeling is an assignment of integer, to its vertices or edges subject to some certain conditions.

All graphs in this paper are finite and undirected. The symbols V (G) and E (G) denotes the vertex set and edge set of a graph G. A dynamic survey on graph labeling is regularly updated by Gallian [3] and it is published by Electronic journal of combinatories. Some basic concepts are taken from Frank Harary [4]. Shalini and Paul Dhayabaran [9] introduced the concept of minimization of multiplicative labeling. In this paper, we investigated some families of graphs such as Ladder, The Shrine, Window which admits minimization of multiplicative labeling.

Definition 1.1

Let G = (V (G), E (G)) be a graph. A graph G is said to be minimization of multiplicative labeling if there exists a bijective function $f : V(G) \to \{1,2,3,\ldots\ldots p\}$ such that, when each edge uv is assigned the label $f(uv) = f(u) * f(v) - \min\{f(u), f(v)\}$, then the resulting edge labels are distinct numbers.

Definition 1.2

A graph G is said to be minimization of multiplicative graph if it admits a minimization of multiplicative labeling.

2.1 Main Results

Theorem 2.1

The graph Ladder L_n is a minimization of multiplicative graphs.

G.SURYA PARAMESHWARI, II M.SC, MATHEMATICS

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SOME OPERATIONS ON n^{th} TYPE INTUITIONISTIC FUZZY SET

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Abstract-- **The primary intention of the paper is to generalize the Intuitionistic Fuzzy Set types that is n^{th} type Intuitionistic Fuzzy Set (IFNT) along with new formula to evaluate the degree of uncertainty and also to define the basic operations and modal operators namely Necessity and Possibility operators over IFNT and to demonstrate the relation between the modal operators.**

Keywords-- **Fuzzy Set (F), Intuitionistic Fuzzy Set (IF), Intuitionistic Fuzzy Set of Second Type (IFST), Intuitionistic Fuzzy Set of Third Type (IFTT), n^{th} Type Intuitionistic Fuzzy Set (IFNT).**

I. INTRODUCTION

The concept of Modern Set Theory, the fundamental for the whole Mathematics was first formulated by George Cantor. A trouble associated with the concept of a set is uncertainty. Because, Mathematics needs its entire notions to be perfect. For a long while this vagueness has been a problem. Recently, it became a critical issue in the field of artificial intelligence. Finally to end this crucial issue (criteria) various concepts were suggested.

One among the suggested concepts was Fuzzy Sets. Lofti Zadeh developed the concept of Fuzzy Set Theory in 1965, in that concept Fuzzy Sets [6] are the collection of objects which has graded membership. Fuzzy sets offers many solution to uncertainties in the area of computer programming, engineering and artificial intelligence. In Fuzzy Set, Membership function replaced the characteristic function in crisp set that take members (elements) from a universe of discourse X to form image in closed interval [0, 1]. In 1983, the idea of Intuitionistic Fuzzy Set (IF) was proposed by Krassimir. T. Atanassov which involves degree of non-membership in addition to the degree of membership of the Fuzzy set. IF reflect better the aspects human behavior.

Following the definition of IF, the extensions of IF namely, IF of second type (IFST) was introduced by Krassimir. T. Atanassov [1]. Syed Siddique Begum and R. Srinivasan introduced the concept of IF of third type (IFTT). In this paper, the IFS types are generalized as n^{th} Type Intuitionistic Fuzzy Set (IFNT) accompanied by new formula to calculate the degree of uncertainty (non-determinacy). The basic operators and modal operators over IFNT are discussed.

In section 2, the vital definitions of Intuitionistic Fuzzy Sets and their extensions are defined. In the next section, the basic operations like union, intersection, subset and complement on IFNT are presented and also the modal operators namely necessity and possibility operators on IFNT are defined. In section 4, the relations between the modal operators are proposed. Finally, few more applications of IFNT in real world are recommended.

CHAPTER PUBLICATION

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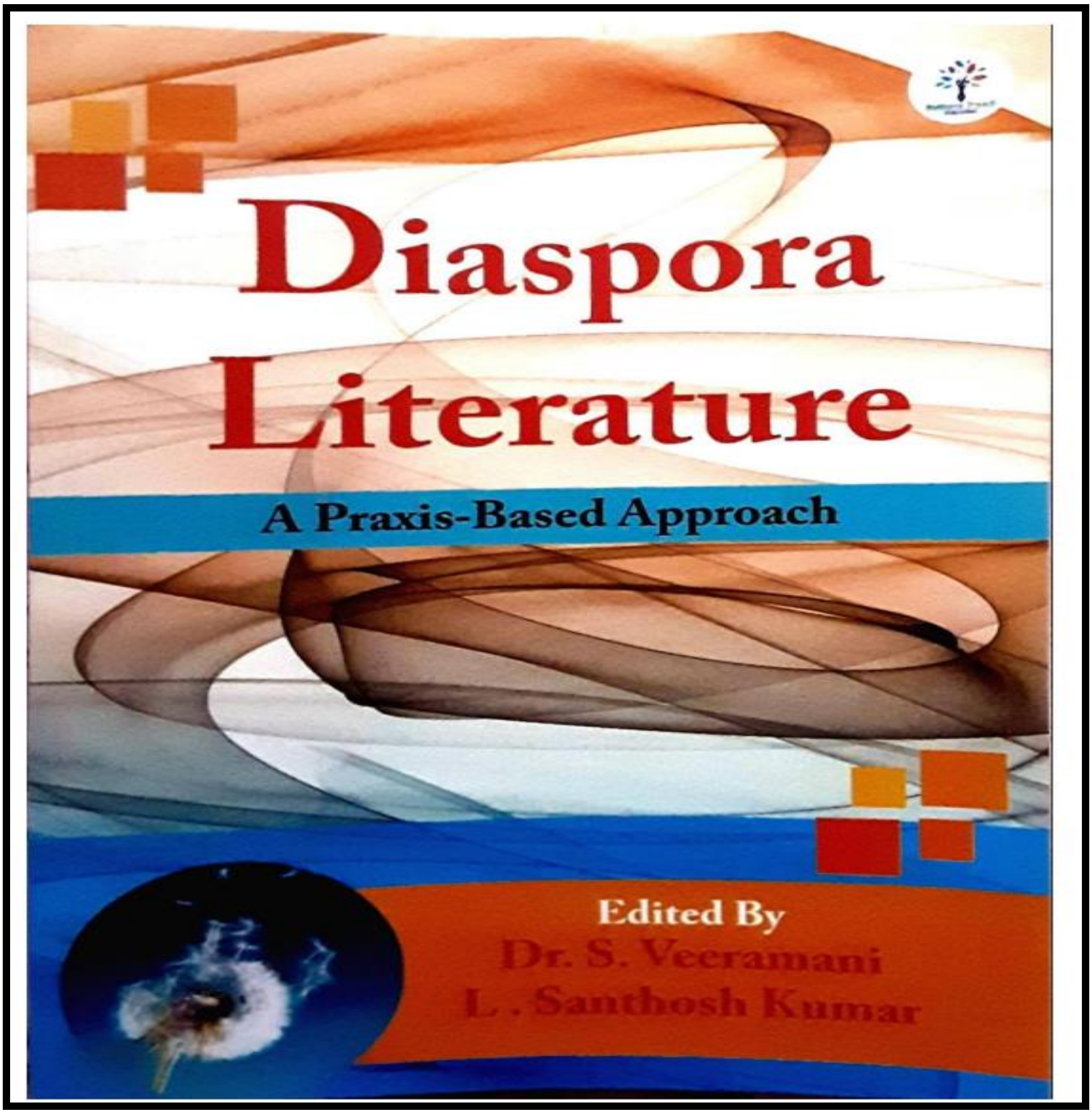

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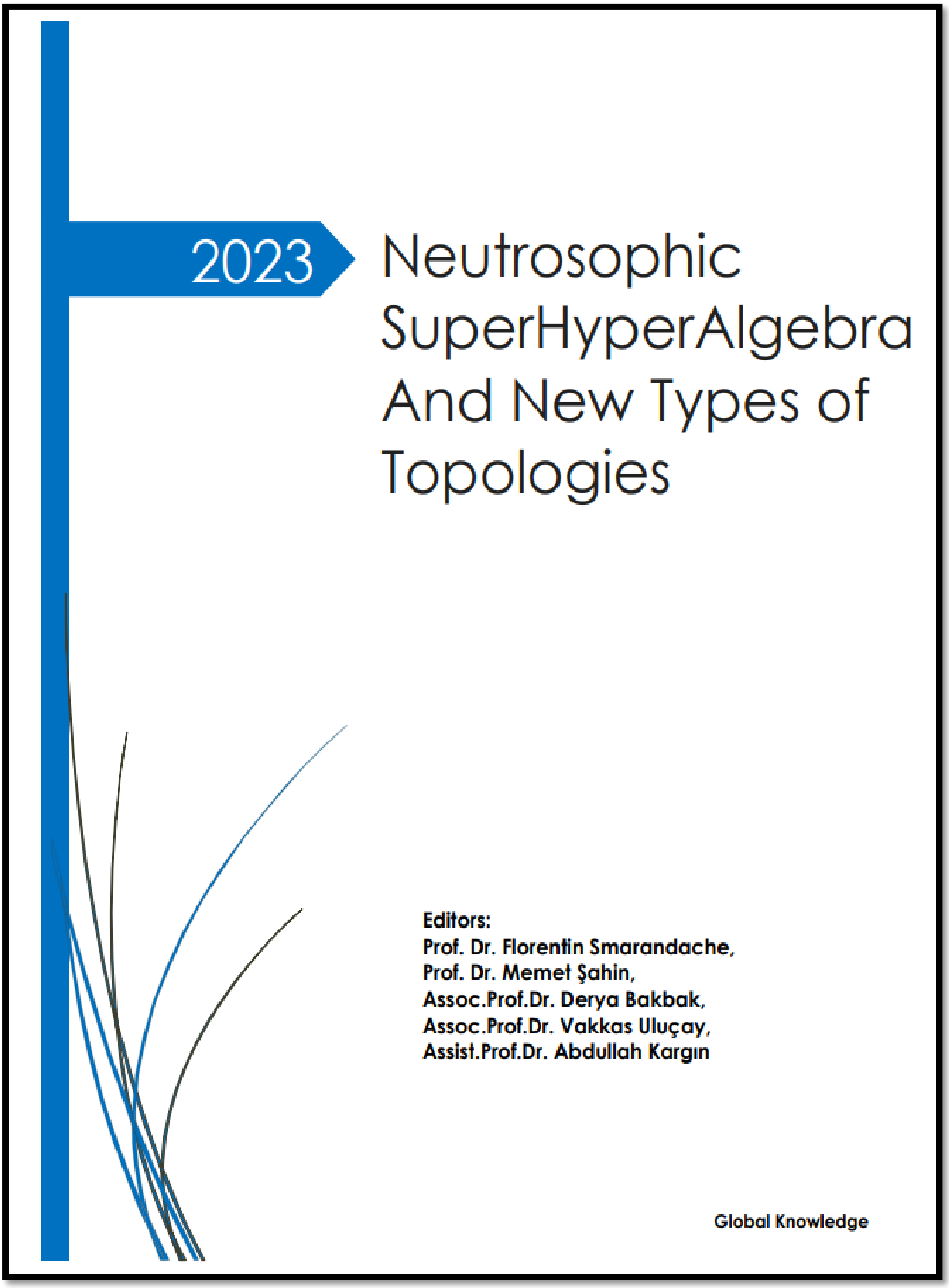

Chapter Twelve

NEUTROSOPHIC INVENTORY MODEL WITH QUICK RETURN FOR DAMAGED MATERIALS AND PYTHON-ANALYSIS

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Abstract
The present study explores two distinct kinds of neutrosophic numbers to solve a neutrosophic control of inventory issue with an immediate return for defective items: triangular neutrosophic values and trapezoidal neutrosophic values. The triangular and trapezoidal neutrosophic figures represent the neutrosophic perfect rate(NPR), neutrosophic demand rates(NDR), and neutrosophic cost of purchase(NCP), respectively. To determine the ideal order quantity (IOQ) in neutrosophic terms, the median rule is applied. The idea for a model is presented with an example of Python analysis.

Keywords: Demand, Inventory Model, Fuzzy set, Neutrosophic, Defuzzification, Python.

1. Introduction

L. Zadeh (1965) was the first to present the idea of fuzzy sets. Since that time, numerous applications involving uncertainty have made extensive use of fuzzy sets and fuzzy logic. However, it has been shown that there are still some instances that fuzzy sets cannot account for, hence the interval-valued (Iv) fuzzy sets(FS) (Zadeh, 1975) was proposed to account for those circumstances. While fuzzy set theory is particularly effective at handling uncertainties resulting from the ambiguity or partial belongingness of an element in a set, it is unable to

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Enhancing Food Resource Allocation in India: A Fuzzy Logic Approach Integrated with Julia and Python

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Abstract

Exploring the intricate network of food resource distribution, especially in the Indian context, this research delves into the multifaceted challenges stemming from poverty and food insecurity. It offers a comprehensive analysis that includes historical perspectives, socio-economic conditions, government policies, and their impact on vulnerable communities. Using innovative methods such as fuzzy logic-based models, Lagrangian optimization, and the Graded Mean Integration (GMI) representation technique, the study provides a systematic approach to allocate resources effectively in food distribution inventory management. By employing the Julia programming language to define and illustrate data for three distinct regions, the research sheds light on critical factors like food poverty levels, budget constraints, demand, supply, inventory, and resource allocation. Additionally, the use of Python libraries for visual representation enhances our understanding of these crucial parameters. Ultimately, this research contributes to the ongoing effort to establish a more equitable and sustainable food distribution system, ensuring access to nutritious food for all individuals, thereby fostering both individual well-being and national prosperity.

Keywords: Food Resource Allocation, Fuzzy Logic Modelling, Lagrangian Optimization, Graded Mean Integration, Data Visualization, India's Food Distribution System.

1.INTRODUCTION

India, with its vast and diverse population, presents a tapestry of stark contrasts. While it stands as a nation with a thriving economy and a burgeoning middle class, it also grapples with deeply entrenched issues of poverty and food insecurity. The allocation of food resources in India has long been a topic of concern and heated debate, as millions of its citizens continue to grapple with inadequate access to nutritious meals. This multifaceted challenge transcends mere economic dimensions; it is intricately interwoven with social, cultural, and political factors. The disparity in food resource allocation reverberates across the nation, impacting the health, well-being, and potential of a significant portion of the Indian population. This discourse endeavours to dissect the multifaceted dimensions of poverty in food resource allocation within India. It takes a historical perspective to

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Chapter 1

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An Analysis on the Ternary Quadratic Diophantine Equation $r^2 + t^2 = 10w^2$

G. Janaki [a++] and S. Shanmuga Priya [a#*]

DOI: 10.9734/bpi/mono/978-81-967488-3-8/CH1

Abstract

In this work, our main focus is on tracing all the non-zero, infinitely many integral solutions to the ternary quadratic equation $r^2 + t^2 = 10w^2$. Of these solutions, some dazzling patterns are shown.

Keywords: Diophantine equation; integral solutions; ternary quadratic equation with three unknowns.

1.1 Introduction

Mathematics, which conveys knowledge of numbers, structures, formulas, and shapes, is the common language of the world. Number theory, a subfield of pure mathematics, studies integers and integral valued functions. Diophantine equations are polynomial equations with at least two unknowns and only integer solutions. The title "Diophantine" relates to *Diophantus of Alexandria* a third-century Hellenistic mathematician who investigated these equations and was one of the first to bring symbolism to algebra. [3, 4, 9, 11] provides knowledge about number theory. In [6], the author has analyzed a quadratic Diophantine equation. In [1,2,5,7,8,10], ternary cubic equations are discussed. More interesting facts on quadratic Diophantine equations can be found in [12-15]. In this work, a homogeneous ternary quadratic equation with three unknowns $r^2 + t^2 = 10w^2$ is taken in order to find few interesting integral solutions.

1.1.1 Notations

- $T_{10,l} = l(4l - 3)$ = Decagonal number of rank l
- $Gno_l = 2l - 1$ = Gnomonic number of rank l

MS. SARULATHA, RESEARCH SCHOLAR

Contents

Chapter 2

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On the Ternion Cubical Diophantine Equation $5(m^2+n^2)-6(mn)+8(m+n)+16=370p^3$

P. Saranya [a*], G. Janaki [a#] and K. Poorani [a†]**

DOI: 10.9734/bpi/mono/978-81-967488-3-8/CH2

Abstract

The third order Cubic Diophantine equation $5(m^2+n^2)-6(mn)+8(m+n)+16=370p^3$ is analyzed for infinitely enormous number of non-zero integer solutions. Also, some fascinating relations among the solutions are exhibited.

Keywords: Diophantine equation; cubic equation; integer solutions; ternary cubic; narcissistic number.

2.1 Introduction

Diophantine equations are equations containing only sums, products and powers where all constants are integers and the only solution of interest is an integer. For example: $x^2+y^2=p^3$, x, y, p are integers. It is named after the 3rd century Greek Mathematician Diophantus of Alexandria; these equations were first solved systematically by Hindu Mathematicians beginning with Aryabhatta.

Diophantine equations fall into three classes: unsolvable, finitely solvable and infinitely solvable. For example, the equation $6x-9y=29$ has no solutions, but the equation $6x-9y=30$ which is divided by 3 yields $2x-3y=10$ with finitely many solutions. For example, $x=20$, $y=10$ is the solution, and $x=20+3t$, $y=10+2t$ in 't', is a one parameter family of solution, where t is an arbitrary.

The congruence method provides a convenient tool for determining the number of solutions to Diophantine equations. Cubic equations are diverse in nature. For more information and understanding of Diophantine type equation [1-8] has been studied. For non-trivial integral solutions of the ternary cubic Diophantine equation [9-10] are

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Chapter 4

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Elucidation of the Transcendence Equation $j+\sqrt{j^3+k^3-jk}+\sqrt[3]{l^2+m^2}=h^3(2^{2n}+1)$

P. Saranya [a++*], G. Janaki [a#] and M. Shri Padmapriya [a†]

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Abstract

We make an effort and elucidate the integral solutions of the transcendental equation $j+\sqrt{j^3+k^3-jk}+\sqrt[3]{l^2+m^2}=h^3(2^{2n}+1)$ under multiple patterns with certain numerical examples.

Keywords: Transcendental; equation; integer solutions.

4.1 Introduction

A transcendental equation is one with the transcendental functions of the variables that need to be resolved. These equations are solved easily until the variables are roughly known. Numerous equations in which the variables appear to provide an argument for only elementary solutions are used to solve transcendental functions.

We frequently label a function as transcendental when an analytical function cannot be solved by a polynomial equation. It cannot be formulated in terms of a finite sequence of addition, multiplication, and root extraction operations in pure mathematics.

The well-known transcendental functions include the logarithmic, exponential, trigonometric, hyperbolic, and inverse of all of the aforementioned [13-15]. Some unexpected transcendental functions are included together with specific functions of analysis like elliptic, zeta and gamma.

[1-2] has been recommended for fundamental notions and concepts in number theory. For fundamental theories and concepts regarding number theory, [3-7] has been analyzed. Transcendental equation-related ideas and problems were collected in [8-12].

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Chapter 3

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Intrinsic Solutions of the Pell Equation $x^2 - 5y^2 + 9^t$

S. Vidhya [a++*], G. Janaki [a#] and B. Amala [a†]

DOI: 10.9734/bpi/mono/978-81-967488-3-8/CH3

Abstract

We search for a non-trivial integer solutions to the equation $x^2 = 5y^2 + 9^t$, $t \in N$, where i) t = 2k+1, ii) t = 2k for all $k \in N$. Additionally the recurrence relation for the solutions are also discovered.

Keywords: Pell equation; Diophantine equation; integer solutions.

3.1 Introduction

The Pell equation $x^2 - dy^2 = 1$ is one of the oldest equation in mathematics and it is fundamental to the study of quadratic Diophantine equations [5-15]. They should be probably called Fermat's equations, since it was Fermat who first investigated the properties of non-trivial solutions of many important such equations [1-4].

In this paper, we search for a non-trivial integer solutions to the equation $x^2 = 5y^2 + 9^t$, $t \in N$, where i) t = 2k+1, ii) t = 2k for all $k \in N$. The recurrence relation for the solutions are also obtained.

3.2 Method of Analysis

Consider the equation

$$x^2 = 5y^2 + 9^t \quad (1)$$

Case 1:

If t = 2k+1, where k = 0, 1, 2, ...

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Chapter 9

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Some Non-Extendable Special Diophantine Triples Involving Nonagonal Pyramidal Numbers

S. Vidhya [a++*], G. Janaki [a#] and T. Gokila [a†]

DOI: 10.9734/bpi/mono/978-81-967488-3-8/CH9

Abstract

In this chapter, we discover the special Diophantine triples for the nonagonal pyramidal number with distinct ranks. The chapter mainly focuses on building three separate polynomials with integer coefficients (*p, q, r*) such as the multiple of any two components of the ensemble increased to their total and prolonged by a non-null integer (or a polynomial with integral coefficients) is a perfect square. In addition, the triple is not extended to a quadruple is analyzed. It is concluded that, we can explore for some other Special Diophantine triples for higher order Pyramidal numbers with equivalent fitting properties.

Keywords: Special Diophantine triples; pyramidal numbers; polynomials; Pell equation; Special Dio Quadruple.

9.1 Introduction

A Diophantine equation is an indeterminate polynomial equation that allows the variables to be integers only [1-5]. Diophantine problems have fewer equations than un- known variables and involve finding integers that work correctly for all equations [16]. Diophantine Analysis is the mathematical study of Diophantine Problems, which was initiated by Diophantus in third century. A set 'P' of m distinct positive integers $\{p_1, p_2, \ldots p_m\}$ is claimed to have own the property D(n) if the multiple of any two components of the ensemble is increased by their total and improved by a non-zero integer n, is a perfect square for all m elements. Such set P is called Diophantine m-tuples of size m. The word Diophantine refers to the Hellenistic mathematician of the 3rd century, Diophantus of Alexandria, who made a study of such equations and was one of the first mathematicians to introduce symbolism into algebra [6-15]. The mathematical study of Diophantine problems Diophantus initiated is now called Diophantine analysis [16]. The extension problem of Diophantine quadruples with the property D (n) for any

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CRITERION II **STUDENT RESEARCH PUBLICATION**

Chapter 8
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Special Dio 3-Tuples Involving Octagonal Pyramidal Numbers

C. Saranya [a++*], G. Janaki [a#] and R. Janani [a†]

DOI: 10.9734/bpi/mono/978-81-967488-3-8/CH8

Abstract

This chapter tries to build special Dio 3-tuples that satisfy the property that the product of any two of the triple's members subtracted by a non-zero integer or a polynomial with integer coefficients is a perfect square. The special Dio 3-tuples from octagonal pyramidal numbers of various ranks are also presented in each of the three parts along with the relevant features.

Keywords: Triples; Diophantine triples; special dio 3-tuples; octagonal pyramidal number; perfect square; pyramidal number.

8.1 Introduction

Number theory is fascinating on the grounds that it has such a large number of open problems that seem accessible from the outside. Of course, open problems in number theory are open for a reason. Numbers, despite being simple, have an incredibly rich structure which we only understand to a limited degree. In the mid twentieth century, Thue made an important breakthrough in the study of Diophantine equations [1-4,18]. The word "Diophantine" refers to the Greek mathematician Diophantus of Alexandria, who developed the use of symbols in variable-based mathematics and investigated related issues in the third century. The subject of the occurrence of Dio triples and quadruples with the property D(n) for any integer n as well as for any linear polynomial in has been studied by numerous mathematicians [5-8]. In this case, [9-16] provides a full study of the many challenges on Diophantine triples. Triple sequences with a half companion were examined in [17].

Our search for Diophantine triples utilizing octagonal pyramidal numbers was prompted by these findings. This study tries to build special Dio 3-tuples that satisfy the property that the product of any two of the triple's members subtracted by a non-zero integer or a polynomial with integer coefficients is a perfect square. The special Dio 3-tuples from octagonal pyramidal numbers of various ranks are also presented in each of the three parts along with the relevant features.

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Chapter 5
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Some Non-Extendable Special Dio 3-Tuples Involving Heptagonal Pyramidal Numbers

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Abstract

In this chapter, we look for three particular polynomials with integer coefficients to such an extent that the product of any two numbers subtracted by a non-zero number (or polynomials with integer coefficients) is a perfect square. This chapter aims at constructing special dio 3-tuples where the product of any two members of the triple with the subtraction of a non-zero integer or a polynomial with integer coefficients satisfies the required property.

Keywords: Special dio 3-tuples; heptagonal pyramidal number; diophantine triples; triples; perfect square; pyramidal number.

5.1 Introduction

Diophantine Analysis is the mathematical study of Diophantine Problems, which was initiated by Diophantus in third century [18]. A Diophantine equation is a polynomial equation in number theory where only the integer solutions are considered or searched for, typically with two or more unknowns [1-4]. The term "Diophantine" relates to the Greek mathematician Diophantus of Alexandria who, in the third century, pioneered the introduction of symbolism to variable-based mathematics and studied related problems.

The problem of the occurrence of Dio triples and quadruples with the property $D(n)$ for any integer n as well as for any linear polynomial in n was studied by a number of mathematicians [5-8]. In this particular situation, one may turn to [9−16] for a thorough analysis of various difficulties on Diophantine triples. Half companion Diophantine triple sequences were studied in [17]. These results motivated us to examine for special dio 3-tuples with involving heptagonal pyramidal numbers. This paper aims at constructing special dio 3-tuples where the product of any two members of the triple with the subtraction of a non-zero integer or a polynomial with integer coefficients satisfies the

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Chapter 7

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Non-Extendability of Special Diophantine Triples Involving Octagonal Numbers

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Abstract

We search for three distinct polynomials with integer coefficients such that the product of any two numbers of the set subtracted with their sum increased by a non-zero integer is a perfect square.

Keywords: Triples; Diophantine triples; Dio 3-tuples; special Diophantine triples; Octagonal number.

7.1 Introduction

The problem of developing the set with property that the product of any two distinct element of the set is increased by n is a perfect square such sets were discovered by Diophantus. The set of m positive integers is known as a Diophantine m–tuples if is an ideal square for all $1 \leq i \leq j \leq m$. Various hypothesis of this issue were considered since ancient rarity, for example by including a proper whole number n rather than 1, looking kth control rather than squares are considering the powers over spaces other than Z or Q. Various mathematicians consider the issue of the presence of Diophantine quadruples with the property $D(n)$ for any self-assured number n and furthermore for any direct polynomials in n.

Notation

Octagonal Number of rank n = $3n^2 - 2n$

Definition:

A set of three distinct polynomials with integer coefficient (a_1, a_2, a_3) is said to be a special diophantine triples with the property $D(n)$ if $a_i * a_j - (a_i + a_j) + n$ is a perfect square, for all $1 \leq i \leq j \leq 3$ where n may be non-zero integer.

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Diophantine Triples Involving Octagonal Numbers

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Abstract

We search for three different polynomials with integer that produce a perfect square when any two numbers from the set are added together and then their sum is subtracted by an integer other than zero.

Keywords: Triples; Diophantine triples; Dio 3- tuples; octagonal number.

6.1 Introduction

The area of mathematics that deals with the study of numbers for their own sake is known as the theory of numbers. For this reason, number theory, which has been studied for more than four thousand years, has typically been regarded as pure mathematics. A Diophantine m-tuple is a set of m positive integers with the attribute D(n). Even though the Diophantine m-tuple problem is a relatively old one, numerous authors have been tackling it using various methods. Diophantine triples considering a recurrence relation in the terms of a special sequence. Many mathematicians considered the problem of the existence of Diophantine triples and with the property D(n) for any arbitrary integer n and also for any linear polynomials n.

Notation:

Octagonal Number of rank n $= 3n^2 - 2n$

Definition:

A set of three distinct polynomials with integer coefficient (a_1, a_2, a_3) is said to be a Diophantine triples with the property *D(n)* if

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