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Graph And Twin Prime Conjecture

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Abstract
In this paper, the definition of complete twin prime vertex and even edge weighted graph has been forwarded. The proof of existence of infinite twin primes has been discussed with a theorem taking the definition. In addition to this the existence of consecutive even number has been discussed in a theorem with the help of the definition and another theoretical result has been put forwarded to find the sum of all twin prime pairs . Two propositions and some remarks have been mentioned.

Keywords: *Complete graph, Partition, Recurrence relation, weighted edge, complete twin prime vertex graph.*

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I. Introduction

Number Theory, which lies in the branch of pure Mathematics, caries so many conjectural problems. It is a never ending Theory relating to numbers. The most important sophisticated branch in number Theory is prime number system. In prime number system, the conjectural problems such as Gold Bach conjecture, twin prime conjecture, Mersenne prime conjecture and perfect number conjecture are playing an important role in the midst of number theorists in general, and different scientists in particular of the world. The Gold Bach conjecture, which states that every even number n greater than2 can be expressed as a sum of two primes. The twin prime conjecture states that if p is prime then p+2 is also a prime, that is we call it twin prime (p,p+2) for some values of $p \geq 3$. It has been found that if p is prime then it is conjectured that $2^{P-1}(2^P-1)$ is a perfect number.The mersenne prime is a prime for some prime p whose form is found as 2^{p-1}. Many attempts have been tried by various authors in different corner of the world to prove these conjectures but it is not completely known whether they are true or false. *The proof of Gold Bach conjecture has been forwarded by Kalita, B [3] considering two types of set of even numbers { 4n+10/ for n≥4} and {4n+12/for n≥4} whose union gives all even numbers ≥26.* It has again been conjectured by Kalita [2006] that all even perfect numbers [as odd perfect numbers are not defined] lie in the set {4n+12/ for some particular values of n ≥4} [conjecture-2 of [3]].The six perfect numbers are obtained for particular six values of n from the set {4n+12 / for some particular values of n} and they are n=4, 121, 2029, 8387581, 2147467261 and 34359672829. But whether the conjecture is true or false is not proved till today. Besides, in 2013*, Kalita, B [1] forwarded the proof of Gold Bach conjecture with the help of Graph Theory taking some new definitions of graphs such a PVEEWG, BKSTPVEEWG, CPVEEWG [1] relating to prime numbers and even numbers.* Thereafter, in the same year Kalita, B etal [2] forwarded a theorem and an algorithm for finding consecutive even number with the help of consecutive even number finding graph [CENFG] which gave sum of two prime numbers as even numbers. Again Kalita,B etal [5] discussed Some graphical partitions of some numbers and forwarded some theoretical results of graphical partition of even numbers of the form 2n+4, 4n+4, (n+1) (n+2) and 6n+2 for n ≥1. It is known that in 1846, the French Mathematician Alphonse De Polignac first study the twin prime conjecture. Thereafter, in 1919 Norwegian Mathematician Viggo Brun showed that the sum of reciprocal of the twin prime converses to a sum, known as Brun‘s constant. Zhang. etal [14] has been discussed in his research findings “Bounded gaps between primes”. Besides, Maynard, etal [15] discussed the small gaps between primes in 2015. In 2019, K.H.K Geerasee, etal discussed the proof of twin prime conjecture in reverse order. The largest twin prime $2996863034895 \times 2^{1290000} \pm 1$ has been found in 2022.It is interesting to note that few twin prime have been found from the relation n±1 for some particular values of n and some of them are n=4,6,12,18,30,42,60,72,102,108,……….. It has also been considered that number theory is a never ending theory, when one result is found to be true then immediately another new problems exists. The new idea of proof of existence of twin primes has been forwarded with the help of application of graph theoretical aspect [discussed later]. The important unsolved twin prime conjecture have been occupying the vital role in prime number system whether there exists infinite twin primes or not.

In this paper, we are going to forward the theoretical proof of existence of infinite twin primes with the help of graph theoretical approach , where the complete graph of even number of vertices has been considered. Two theorems relating to the existence of consecutive even number and sum of twin primes have also been proposed and proved. Before going to prove the conjecture, the following notations, terminology and some definitions have been considered**.**

The paper is organized as follows: In section 1, the explanation of different works has been focused. Section 2 includes notation and terminology. In section 3, some definitions from 3.1 to 3.6 are mentioned with a new definition 3.7. Section 4 is considered for some properties. Theoretical section 5 includes some theorems. Propositions are included in section 6. Finally in section7, conclusion is included.

II. Notation And Terminology:

The notation and terminology are considered from standard references [1-11]. For the graph G(m, n), m denotes the number of vertices and n the number of edges. If p is a prime then p+2 is also a prime and p, p+2 is called twin prime. We consider the twin prime (p, p+2) as a twin prime pairs. We denote P(n), a partition function for the number n and we consider the complete graph of even number of vertices as K_{2m+2} for m ≥2. The symbol ⊆ is used for subgraph of a graph.

III. Some Definitions:

Definition 3.1: A graph G(V,E) consists of two non-empty sets , V and E where the elements of V are called vertices and the elements of E are called edges and for every edge e={ $V_{i,}$, V_j) , V_i , V_j €V and they are called the end vertices of the edge e.

Definition 3.2: A graph G(V,E) is called simple if it is without self-loop and parallel edges.

Definition 3.3: A circuit C of a graph G is called Hamiltonian circuit if the starting and ending vertex are same and it includes all the vertices of the graph and such a graph is called Hamiltonian graph.

Definition 3.4: The partition of a positive number n is a sum parts of n as n=n1+n2+n3+n4+……………….and it is denoted as P(n). For example, the partitions of 3 that is P(3) are 3,2+1,1+1+1 and the partitions of 4 that is P(4) are 4,3+1,2+2,2+1+1,1+1+1+1.

Definition 3.5: A Graph (V,E) is called complete graph in which every pair of vertices is connected by a unique edge. It is denoted by K_n, where n is the number of vertices for n ≥2. It is found that the number of edges of the complete graph of n vertices is n (n-1)/2 and the total number of Hamiltonian circuits is (n-1)Ị /2 . The complete graph may have even number or odd number of vertices. We consider here the complete graph of even number of vertices.

Definition 3.6: A complete graph (V,E) is an infinite complete graph if the number of vertices and edges are infinite. [Such graph has already been considered for sufficiently large complete graph in Ramsey theorem]

Definition 3.7: Let K_{2m+2} for m≥2 be a complete graph. A complete graph K_{2m+2} for m ≥2 is called a Complete Twin Prime Vertex Even Edge Weighted Graph [CTPVEEWG] if the twin primes are attached with the vertices of the complete graph K_{2m+2} for m ≥ 2. The weight of the edges are defined as the sum of two twin primes. This graph is denoted by $CTPVEEWG_{2m+2}$ (V,E) for m≥2, [Complete Twin Prime Vertex Even Edge Weighted Graph], where V denotes the set of twin primes and the set E consists of the weighted edges obtained from the sum of two twin primes. Here the weight of the vertices are nothing but the twin primes and weight of the edges are always even number. As there are even number of vertices of the complete graph K_{2m+2} for m≥2, hence twin prime pairs (p, p+2) for p≥5 are considered and they are attached with the vertices of the graph. For m=2, we have three twin prime pairs (5, 7), (11,13), (17,19) and the primes 5,7,11,13,17 and 19 are attached with the vertices of the complete graph K_6 [Figure-1 for m=2]

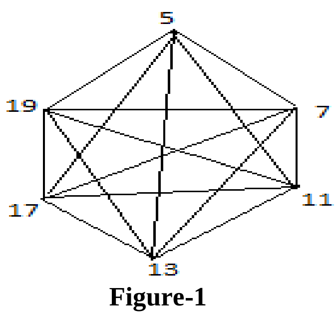

Figure-1

It is interesting to note that as the form of twin prime pairs is (p,p+2) for p≥5, where p is prime and hence for the graph $CTPVEEWG_{2m+2}$ (V,E) for m≥2, we can consider the three twin prime pair, four twin prime pairs, five twin prime pairs,……………………………………etc. When m=2, the graph $CTPVEEWG_6$ (V,E)

[Figure-1] has three twin prime pairs and there are fifteen weighted edges according to the property of complete graph [definition5] which are 5+7=12, 5+11=16, 5+13=18, 5+17=22, 5+19=24, 7+11=18, 7+13=20, 7+17=24, 7+19=26, 11+13=24, 11+17=28, 11+19=30,13+17=30, 13+19=32,17+19=36. It is known that the edges of the complete graph K_{2m+2} for m≥2 is $2m^2+3m+1$ for m ≥2. Hence, we are going to study the existence of infinite twin prime with the help of $CTPVEEWG_{2m+2}$ (V,E) when m →∞ . We again study whether this graph will give the consecutive even numbers which are nothing but the sum of two twin prime. Here, when m tends to infinity then the graph $CTPVEEWG_{2m+2}$ (V,E) for m≥2 produces an infinite complete twin prime vertex even edge weighted edges graph and we shall use it in later part of the paper.

IV. Properties:

Property 4.1: The weight of the edges of the graph $CTPVEEWG_{2m+2}$ (V,E) for m≥2 always represent even numbers.
Property 4.2: The graph $CTPVEEWG_{2m+2}$ (V,E) for m≥2 has only one weighted edge with minimum weight 12.
Property 4.3: For the graph $CTPVEEWG_{2m+2}$ (V,E) for m≥2 the repeated weighted edges are considered as two different edges to satisfy the property for the number of edges $2m^2+3m+1$ for m ≥2.

V. Theorems

Three theorems have been discussed here.
Theorem 5.1: From the graph $CTPVEEWG_{2m+2}$ (V,E) for m≥2, the consecutive even numbers (consecutive even weighted edge) can be found if the deletion of weights satisfy the following recurrence relation F(m) ,where
F(m)=0 if m ‹ 2
=2 if m=2 [deletion of only two weights one smallest and another greatest weight]
=2 if m=3 [deletion of only two weights, one smallest and another greatest weight]
=4n+2 for n ≥1 with simultaneous changes of m≥4. [Deletion of one smallest weight and others greatest weights etc].
Proof: We know that the graph $CTPVEEWG_{2m+2}$ (V,E) for m ≥2 has $2m^2+3m+1$ number of weighted edges for m ≥2. It is seen that there may have some repeated weighted edges in the graph $CTPVEEWG_{2m+2}$ (V,E) for m ≥2 and they are considered as different weighted edges [property 4.3] for the graph to satisfy the relation of edges $2m^2+3m+1$ for m ≥2. The theorem is true for m=2. For m=2, we have the graph $CTPVEEWG_{2m+2}$ (V,E) is a graph of six vertices, where three twin prime pairs are attached with the vertices[Figure-1] and there are 15 edges. These 15 weighted edges give the 15 even numbers [property 4.1] which are obtained from the graph of Figure-1. Here the repeated weighted edges say 18=5+13 and 7+11=18 are considered as two different weighted edges, otherwise it does not satisfy the property of having the number of edges $2m^2+3m+1$ for m =2 . Hence for m=2 we must delete two weights, one smallest weight 5+7=12 and one greatest weight 17+19=36 to get consecutive even weighted edges (even numbers), according to the statement of recurrence relation F(m) from the graph $CTPVEEWG_6$ (V,E) for m=2. Therefore, nine consecutive even weighted edges (even numbers) are obtained from the graph $CTPVEEWG_6$ (V,E) for m = 2, after deletion of two weighted edges 12 and 36 and they are 16,18,20,22,24,26,28,30,32 . Hence the theorem is true for m=2. The theorem is also true for m=3 and the graph $CTPVEEWG_8$ (V,E) has 28 weighted edges (even numbers) but not consecutive and out of these 28 weights ,there are some repeated weights which are considered as different edges. We see here that, when the smallest weight 5+7=12 and greatest weight 29+31=60 are deleted from the 28 weighted edges then have the following consecutive even weighted edges (consecutive even numbers) starting from 16 to 50 and they are 16, 18, 20 22, 24 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50. Hence for two values of m=2 and m=3 the theorem is true. Here F(0)=0 for m <2. Now as the third condition of recurrence relation is related with two different numbers namely n and m, we now show that the theorem is also true for such values of n ≥1 for simultaneous changes of m≥4.

We now use induction method for third condition of recurrence relation mentioned in the statement of theorem. When we consider n=1 and m=4 (as the statement of recurrence relation give the different values of m with simultaneous changes of n), then the graph $CTPVEEWG_{10}$ (V,E) will have five consecutive twin prime pairs (5,7),(11,13),(17,19),(29,31) and (41,43) and the prime numbers 5,7,11,13,17,19,29,31,41 and 43 are attached with the vertices of the graph, and then there will have 45 number of weighted edges. (even numbers). Then six weights are deleted (4n+2=6 for n=1) and they are 12, 70,72,72,74 and 84. [Here 72, 72 represent two different weighted edges] After deletion of the above six weights , we have the consecutive weighted edges (consecutive even numbers) and they are 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62,which shows that for n=1, with simultaneous changes of m=4, the theorem is true.

We now suppose that the theorem is true for m=l≥4 and n=k ≥1.Hence the number of deleted weights are 4k+2, with simultaneous changes of m=l≥4 for the graph $CTPVEEWG_{2m+2}$ (V,E). Now without loss of generality, we can suppose that m=l+1 with simultaneous changes of n=k+1. As we have supposed the value of m≥4 with simultaneous changes of n≥1, hence for the values of m=l+1≥5, and consequently for the value of n=k+1, we have 4(k+1)+2 = 4k+6. As n=k≥1 then definitely k+1≥1 implies k≥0, and l+1≥5, implies that l≥4.

This completes the proof.

Remark 1: The proof of Gold Bach conjecture has been forwarded and proved by taking graph theory concept with the help of some new definitions of the graphs such as PVEEWG, BKSTPVEEWG,CPVEEWG [1] and the same concept is considered here for the graph $CTPVEEWG_{2m+2}$ (V,E) for m≥2.

Theorem 5.2: The sum of all twin prime pairs can be evaluated from the sum of the numbers a, b, and c, where a=Σ2n=n(n+1), b=Σ(4n+6)=$2n^2$+8n, c=Σ(6(I) , where the values of n≥1 are considered for a and b and the values of i ≥0 are considered for c .

Proof: We have applied here the definition [3.4] of partition of numbers and the proof depends on the induction method .Consider the first pair of twin prime (5,7). Now consider the partition of 5 and 7 .It is found that one of the partition of 5 is 2+3 and similarly we have one of the partition of 7 is 4+3. We are going to prove that the theorem is true for n=1 and i=0. We have the sum of 5 and 7, that is 5+7=12, which is equal to their sum of partitions that is 2+3+4+3=12. Hence the sum of the twin primes 5 and 7 equals 12 , which is nothing but the sum of the numbers a, b and c, where a=Σ2n=n(n+1)=2 for n=1 and b=Σ 4n+6=$2n^2$+8n=10 [b=3+4+3=10] for n=1 and c= Σ6(i) i=0 , which shows the correct result for n=1 with simultaneous changes of the values of i=0. Let the result be true for n=k for simultaneous changes of i=m. Now we shall show that the results is true for n=k+1 with simultaneous changes of i=m+1. When we suppose n=k+1 and then we have a=Σ2(k+1) =(k+1)(k+2) and similarly b=Σ4(k+1)+6=$2(k+1)^2$+8(k+1),and the third number c=∑6(m + 1)= ∑(6m+6). As n≥1 and hence k+1≥1 which implies k≥0 and when i≥0 then m+1≥0, which implies that m ≥-1, and this completes the proof.

Remark 2 : One can show the sum of two prime pairs (5,7) and (11,13) when n=2 and i=1 and then a+b+c=36 , where a= ∑2n=6 ,b=∑4n+6=24 and c=∑6i=6 . Similarly for the sum of three twin prime pairs (5,7),(11,13) and (17,19) , when n=3 and i=2 and then a+b+c=72, where a=∑2n=12, b=∑4n+6=42 and c=∑6i=24. Etc.

Theorem 5.3: The number of weighted vertices of the graph $CTPVEEWG_{2m+2}$ (V,E) for m ≥2 are always infinite [infinite twin primes] when m→∞ [for sufficiently large values of m].

Proof: It is known that there are 2m+2 vertices of the complete graph K_{2m+2} for m≥2 and there are $2m^2$+3m+1 edges for m ≥2. Therefore the graph $CTPVEEWG_{2m+2}$ (V,E) also have 2m+2 number of weighted vertices and $2m^2$+3m+1 number of weighted edges. It is interesting to note that the complete graph K_{2m+2} for m≥2 is a graph obtained from the graphical partition of the numbers (n+1)(n+2) for n≥1, according to the Theorem 2.3 of [5] which shows that the graphical partition of the number of the form (n+1)(n+2) for n ≥1 always contain one complete graph having n+2 vertices with degree (n+1) of each. Hence the graph $CTPVEEWG_{2m+2}$ (V,E) for m ≥2 is also a complete graph obtained from one of the graphical partition of the number (n+1)(n+2) for n≥1.When n=4,then (n+1)(n+2) =30 and one of the graphical partition of 30 is 5+5+5+5+5+5 and hence there is a complete graph of six vertices and each vertices are of degree 5 . But, we know that infinite complete graph is related with the Ramsey's theorem which states that any complete infinite graph [definition6], sufficiently large complete graph whose edges are colored by K-colors will contain an infinite monochromatic complete sub-graph [7]. Hence we can take the graph $CTPVEEWG_{2m+2}$ (V,E) for m ≥2 as infinite complete graph when the value of m tends to infinity [sufficiently large] which is explained with the following steps and hence our aim is to show that for the infinite vertices of infinite complete graph, we can attach infinite twin primes pairs (p, p+2) with the vertices of the infinite complete graph. Let S be an infinite set of vertices of the graph $CTPVEEWG_{2m+2}$ (V,E) when m→∞ ,where S={Pi , 1 ≤ i ≤ ∞ }.Therefore P1, P2, P3, P4, P5, P6, P7, P8, P9, P10…………………………………..,…………………P∞, P∞+2 are the element of S. We now can consider the twin prime pairs which are represented as (P1, P2), (P3, P4), (P5, P6), (P7, P8), (P9, P10)……………………….(P∞, P∞+2). The pair (P∞, p∞+2) is a twin prime pair according to the definition of the graph $CTPVEEWG_{2m+2}$ (V,E) ,when m tends to infinity. We start our first twin prime pair (5,7) and which is represented as (5,7)=(P1,P2) and similarly second twin prime pair is represented as (11,13)=(P3,P4) …………………….and similarly other twin primes pair are represented accordingly. Hence we can represent infinite twin prime pairs such that (R,T)=(P∞,P∞+2). Now consider the complete graph K_6 as shown in Figure-1 [definition6]. It has already been discussed that from three twin prime pairs (5,7), (11,13) and (17,19), when attached them with six weights 5,7,11,13,17 and 19 with six vertices of K_6 for m=2 then there are 15 weighted edges for our graph $CTPVEEWG_6$ (V,E). Now, without loss of generality we try to find one infinite complete graph, considering the graph $CTPVEEWG_6$ (V,E) [Figure-1] . Now joining the vertices of the graph of figure-1 with infinite twin primes P7, P8 , P9, P10, P11, P12, P13, P14, P15, P16, P117,P18,P19,P20,P21,P22,P23,P24,P25 ,P26, P27, P28……………………………………………………………

……………………..……………………………………………………………………………………………

………………………………..……………………………………………………………………………………….P ∞, P∞+2 in such a way that every pair of vertices are connected by an edge. Therefore P∞ is connected with the vertices P1,P2,P3,P4,P5,P6,P7,P8………………p∞+2 and similarly P∞+2 is also connected with the vertices P1,P2,P3,P4,P5,P6,P7,P8 ……………..P∞ and Similarly other vertices are also connected with every vertices of the graph of Figure-1 ,and finally we have an infinite complete graph [Figure-2],

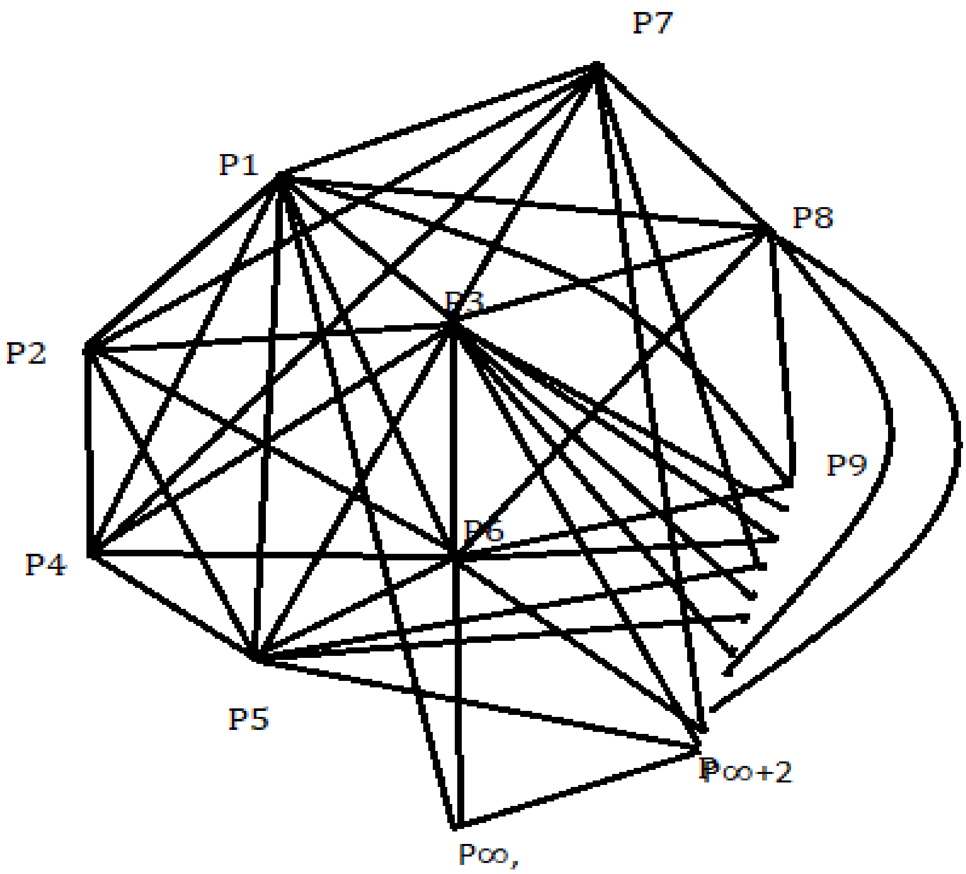

Figure-2

Which connect twin primes P∞ and P∞+2 with other vertices of the graph of Figure-1. Finally we have a sufficiently large complete graph when m →∞. Let this graph be CTPVEEWG∞ (V, E). It is true that the degrees of each vertex of the graph $CTPVEEWG_{2m+2}$ (V,E) are 2n+3 for n≥1 for the simultaneous changes of m≥2. Thus without loss of generality, we can consider the degree of each vertex of the infinite complete graph CTPVEEWG∞ (V,E) is also sufficiently larger than 2n+3 when n tends to infinity for simultaneous changes of m →∞. According to the infinite complete graph CTPVEEWG∞ (V,E) of Figure-2, we have the sum of the weights P1+P∞,P2+ P∞,……………………….. P∞+P∞+2, P1+ P∞+2, P2+ P∞+2, P3+ P∞+2 ,…………………………. P∞+2+ P∞ ……………………. are also sufficiently large even numbers by definition 7. Again we know that the addition/subtraction of two even number is again even. Now considering this simple property we now consider two even numbers say P1+P∞ and P1+ P∞+2, and when add them, we have (P1 + P∞) +(P1+P∞+2) = 2P1 + (P∞+P∞+2)=Sufficiently large even number, say M . This implies that P∞+P∞+2= M-2P1, which is again a sufficiently large even. Hence we have the pair (P∞, P∞+2) is a twin prime pair, which lie in the set S={Pi , 1 ≤ i ≤ ∞ }. Therefore, the number of weighted twin prime pair is infinite, which shows that there exists infinite twin primes . This completes the proof.

VI. Proposition

Proposition 6.1: The sum of a, b , c obtained from theorem2 gives a number of the form equal to 12L, where L are dependent on 2n,2n-1,2n+1, for different values of n and they are called *Bichitra Constant* [BC]. Some values of n are 1, 2, 3, 5, 9, 14, 20, 27, 36, 49, 61, 76, 92, 109, 129, 148, 170, 194 …………………………………… for which we have different values of L and they are 1, 3, 6,11,18,28,40,57,75,98,123,153,185,218,256,296,341,388,…………..……..,…………………………………… …………….When L=1 the value of n is dependent on 2n-1 for n=1 and the sum of a, b and c is 5+7=12, and

Bichitra Constant is 1, When L=3 ,the values of n is dependent on 2n-1 for n=2 and the sum is 5+7+11+13=36 , and Bichitra Constant is 3. When L=6, the values of n is dependent on 2n for n=3 and the sum of 5+7+11+13+17+19=72 and Bichitra Constant is 6 ………………etc.

Proposition 6.2: The sum of the edges the complete graphs K_2, K_4, K_6, K_8, K_{10}, K_{12}, K_{14},…………………K_{2m} for m≥2 which are ⊆ [sub-graphs] of the infinite complete graph K∞ may be approximately 2^{n-1} +5(n-1)+4(n-1)(n-2)+[3(n-1)(n-2)(n-3)/6] for m≥1 with simultaneous changes of n≥1 .That is 1+6+15+28+………………+2m^2-m is approximately 2^{n-1} +5(n-1)+4(n-1)(n-2)+[3(n-1)(n- 2)(n-3)/6] for m≥1 with simultaneous changes of n≥1.

VII. Conclusion And Future Reflection:

Three theorems have been discussed. The theorem5.1 gives all the consecutive even numbers which are forwarded from the application of recurrence relation. In theorem5.2, the evolution process of sum of all twin prime pairs have been discussed. Finally, in theorem 5.3, the proof of twin prime conjecture has been forwarded with graph theoretical concept. Two propositions have been focused. The new application of graph theoretical results may play sophisticated vital role in number theory problems.

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References

[1] Kalita, B; Graph And Goldbach Conjecture, 2013, International Journal Of Pure And Applied Mathematics, Vol.82, No.4, 531-546 Doi: Http://Dx.Doi.Org/10.12732/Ijpm.V82i4.3

[2] Kalita, B, Etal; Consecutive Even Number Finding Graph (Cenfg) Related To Goldbach Conjecture, 2013, International Journal Of Pure And Applied Mathematics, Vol.89, No.1 ,55-70,Doi: Http://Dx.Doi.Org/10.12732/Ijpm.V89i1.7

[3] Kalita, B; Proof Of Goldbach Conjecture And Related Conjecture Of Prime,2006, Bulletin Of Pure And Applied Sciences, Vol. 25e(N0.2) 451-459.

[4] Kalita, B; Certain Forms Of Even Numbers And Their Properties, 2009, Global Journal Of Pure And Applied Mathematics, Vol.5 No.1,2009, 53-58

[5] Kalita, B; Etal; Some Properties Of Graphical Partitions,2009, International Journal Of Applied Engineering Research, Vol.4, No.10, 1851-1856.

[6] Kalita, B; Some Conjectural Problems Of Primes And Partial Solution Of It,2000, Abstracted, International Conferences On Recent Advances In Mathematical Sciences Iitk, 2000, Dec 20-22.

[7] Isabella, Scott; A Conversation Between Model Theory And Graph Theory, August/2016

[8] Kalita, B; Sub –Graph Of Complete Graph,2006, International Conf Of Foundation Of Computer Science Isbn-1-60132-015-9, Pp71-77, Las Vegas, Usa.

[9] Kalita, B; Non-Isomorphic Hamiltonian Sub-Graph Of Complete Graph And Their Application ,2006, Proceeding Of 92nd Indian Science Congress, January3-7,2006, Ahmedabad, India.

[10] Kalita, B, Etal; Graph Factorization And Its Application,2012, International Journal Of Management , It And Engineering, Vol.2 Issue 3, 209-220.

[11] Kalita, B; Some Investigations On Graph Theory,2003 Phd Thesis, Gauhati University

[12] Lane Barton Iv "Ramsey Theory" May13,2016

[13] Zhang Etal ,2014 "Bounded Gaps Between Primes" Annals Of Mathematics,179(3) 1121-1174

[14] Maynard. Etal,2015 "Small Gaps Between Primes", Annals Of Mathematics, Second Series.181(1) :383-413

[15] K.H.K Geerasee Etal ,2019, In Detail Explanation For The "Proof Of The Twin Prime Conjecture" And It's Application To Thermal Physics.