ENCRYPTION THROUGH BALANCE GRAPH

ABSTRACT

The preservation, security, and concealment of private and confidential information has become a crucial element of everyone's life in today's fast-paced, high-tech world. This research looks at ways of encrypting and concealing sensitive information in order to improve security. A mix of two-branch cryptography and graph labelling is used to achieve this. In the first step, text would be encrypted using the proper balance graph and its Fibonacci product cordial labelling processes. The message would be hidden at the second level using cryptography. Furthermore, any individual, group of individuals, or organisation can use this method to conceal and protect sensitive corporate information, national secrets, laboratory secrets, or important defined information.

Keywords :- *Fibonacci Edge Product Cordial Labelling, Balance Graph, Coding, Decoding, Encryption.*

Introduction:

In today's fast-paced, high-tech culture, the protection, security, and concealment of private and secret information has become an essential part of everyone's life. The purpose of this research is to combine cryptography and graph labelling to protect secret communication. Communication can be sent securely from one party to another using cryptography. A secret key called cypher text is employed to transmit a message. We have numerous options for encrypting the message. This method can give more realistic, trustworthy, and high-standard safety, security, and privacy for messages and codes.

Main Results :

Fibonacci Product Cordial Labelling

Let ϕ be an injective function defined as $\phi : V(G) \to \{F_1, F_2, \ldots F_n\}$ where F_k is the k^{th} Fibonacci number $1 \leq k \leq n$ and the induced function $\phi^* : E(G) \to \{0,1\}$ defined by $\phi^*(uv) = \phi(u)\phi(v) mod\ 2$ satisfies the condition $|e_{\phi*}(0) - e_{\phi*}(1)| \leq 1$. Then ϕ is said to be Fibonacci product cordial labelling. A graph which admits Fibonacci product cordial labelling is called Fibonacci product cordial graph.

Balance Graph

A balance graph $Ba(n)$ is a graph formed by linking the apex vertices of two copies of a shell graph by an edge. The first shell is known as the balance graph's first plate, while the second shell is known as the balance graph's second plate. A beam is the edge of the balance graph that connects two plates. The end vertices of the beam are the apex vertices of the balance graph.

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Scale vertices are the other vertices on the plates. The edge that joins a scale vertex and an apex vertex of a plate is known as a plate string. A chain in a balance graph $Ba(n)$ is defined as a line linking the respective strings of the plates and beam. In a balance graph $Ba(n)$, there are $n-1$ chains, each with four vertices. The names of the vertices in the i^{th}chain are C_{i1}, C_{i2}, C_{i3} and C_{i4}.

Fibonacci Product Cordial Labelling for Balance Graph:

Let $Ba(n)$ be the graph obtained by joining two copies of the Shell graph by an edge. Let u_1(apex) $, u_2, u_3, \ldots, u_n$ (chord vertices) be the successive vertices of the first copy of the Shell graph S_n and let v_1(apex), $v_2, \ldots v_n$ (chord vertices) be the successive vertices of the second copy of the Shell graph S_n . Assign the Fibonacci number F_1 to the apex vertex and F_2 to the scale vertex on the first string of the first plate. The other scale vertexes on the first plate are labelled $F_3, F_4 \ldots F_n$ accordingly. The second plate's apex vertex is labelled F_{n+1} and the scale verties from the last string of the second plate are labelled $F_{n+2}, F_{n+3} \ldots F_{2n}$ accordingly.

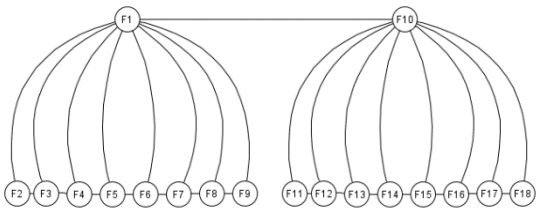

Figure 1: FPCL of Balance Graph Ba (9)

Coding

Using a hint, choose an appropriate balance graph. Then apply the Fibonacci product cordial labelling for the balance graph. A suitable approach is used to convert each letter in the given message into a Fibonacci number.

Find these figures on the balance graph after that.

MSFN-Method of Shuffle Fibonacci Number

A	B	C	D	E	F	G	H
F7	F8	F9	F10	F11	F12	F19	F20
I	J	K	L	M	N	O	P
F21	F22	F23	F24	F26	F25	F13	F14
Q	R	S	T	U	V	W	X
F15	F16	F17	F18	F1	F2	F3	F4
Y	Z						
F5	F6						

Figure 2: Codes Using MSFN

In this method, we can shuffle the Fibonacci numbers and assign them to English letters. In this paper, the first six Fibonacci numbers are used to correspond with the final six alphabets, the second six Fibonacci numbers are used to correspond with the first six alphabets, and so on.

Encoding

The proper procedure should be used to code each letter in the given message. Any chosen format can be used to deliver the coded message. The receiver must understand how to decode the received code and the Fibonacci product cordial labelling of the balance graph.

Illustration 1

Message: KEY IS IN THE CAR
Clue: Thirteen stars are in the sky
Graph: The Balance graph $Ba(13)$ is considered.
Labelling: The Fibonacci Product cordial labelling for $Ba(13)$ is used.

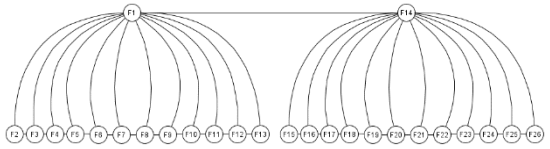

Figure 3: FPCL of Balance Graph $Ba(13)$

In the first plate, the scale vertex of the i^{th} string is denoted by $\%i$ while in the second plate, it is denoted by $\#i$. The first plate's apex vertex is coded as %%1 and the second plate's apex is coded as ##2. To separate each word, we can use %# . We can use the relation $x \equiv y \, mod \, 26$, if the Fibonacci number used in the balance graph is greater than F_{26}. If the biggest Fibonacci number used in balance graphs is less than F_{26}, the letters corresponding to the remaining Fibonacci numbers are denoted by Δ_i , Δ_{i+1} and so on.

KEY #9%10%4

IS #7#3

IN #7#11

THE #4#6%10

CAR %8%6#2

We can present the letter code in a horizontal string, and use any suitable method to express the coded message. #9%10%4%##7#3%##7#11%

##4#6%10%#%8%6#2

#9%10%4 %#
#7#3%##7
#11%##4#6
%10%#%8%6#2

Figure 4: Encrypted Message

Follow the next few instructions to decode the message. Write the codes in a string first. Then ascertain how many words the given message contains. This can be done by counting the %# symbols in the coded message. Use your knowledge of the Fibonacci product coding labelling of the balance graph and coding technique to decode each letter of the word.

Illustration 2

Message: TAKE TEN STEPS BACK
Clue: Seven stars are in the sky
Graph: The Balance graph $Ba(7)$ is considered.
Labelling: The Fibonacci Product cordial labelling for $Ba(7)$ is shown below.

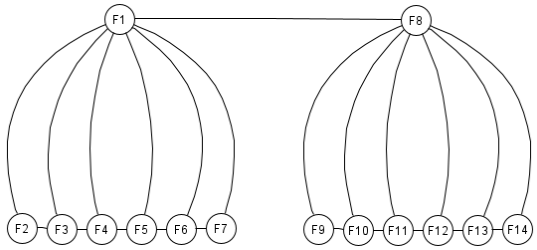

Figure 5: FPCL of Balance Graph $Ba(7)$

Let C_{ij} denote the number assigned to j^{th} vertex in the i^{th} chain of vertices, M_{0i} denote the remaining letters, if the Fibonacci number used in the graph is less than F_{26} and C_{0i} denote the gaps between words

TAKE -$M_{04}\ C_{61}\ M_{09}\ C_{34}$

TEN-$M_{04}\ C_{34} M_{11}$

STEPS-$M_{03}\ M_{04}\ C_{34}\ C_{64} M_{03}$

BACK-$C_{13}\ C_{16}\ C_{14} M_{09}$

The letter code can be displayed as a horizontal string, and the coded message can be expressed in any way that is appropriate.

$M_{04}\ C_{61}\ M_{09}\ C_{34}\ C_{01}\ M_{04}\ C_{34} M_{11} C_{06}$

$M_{03}\ M_{04}\ C_{34}\ C_{64} M_{03}\ C_{04}\ \ C_{13}\ C_{16}\ C_{14} M_{09}$

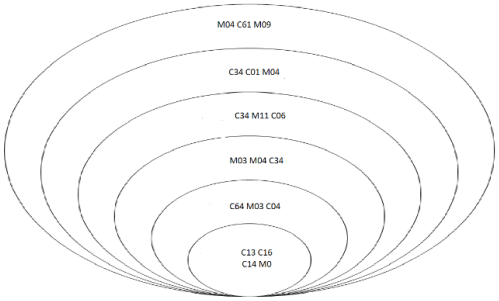

Figure 6: Encrypted message

To decode the message, complete the next few actions. The total number of codes (19 in this case) must be subtracted from the total number of codes of the form C_{0i} (3 in this case) to obtain the number of letters in the given message (16 in this case). By creating a 16-box design and placing the letters in each box according to the given order, the message can be decoded.

Conclusion

The goal of this study is to investigate the use of Fibonacci product cordial labelling in cryptography in depth. In the future, it will be feasible to gain not only a new technique for improving information security, but also a broad use of graph labelling in general.

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