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Application of Magic Squares in Cryptography

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Abstract. In this paper, the magic square is used as a substitution cipher text in cryptography. The method for encryption and decryption of information is proposed by constructing magic squares with the help of Narayana's folding method and Knight's move method. The validity of proposed model has been analyzed by encryption and decryption of alphabets, numeric digits and symbols. Also, both the methods used for the construction of magic square are represented in a different way as compared to the traditional method.

Keywords: Magic square · Cryptography · Knight's move method · Narayana's folding method · Arithmetic progression

1 Introduction

A magic square is a square matrix of order n with the additional property that the sum of elements in each row, each column, main diagonal and anti diagonal always remain the same. The fixed sum associated with magic square is known as magic sum. The magic square in which only row and column sum remains fixed and the condition for diagonals is not required is known as semi-magic square. Emperor Yu, in China, was supposed to have been the first who discovered magic square marked on the back of a divine tortoise only symbolically. After that, in India a lot of work has been done on magic squares. The work of the ancient seer Garga contain several 3×3 magic squares. The Buddhist philosopher Nagarjuna (c. 2nd century AD) gave a general class of 4×4 magic squares. In Brihatsamhita of Varahamihira (c. 550 AD), a description of a 4×4 magic square, referred to as sarvatobhadra, was found. The 4×4 pan-diagonal magic square was found at the entrance of Jaina Temple at Khajuraho in 12th century as described in [4]. The construction of magic squares was done in 1356 AD by Narayana Pandita in his celebrated work Ganitakaumudi. He discussed the general methods for the construction of samagarbha (doubly-even), visamagarbha (singly-even) and visama (odd) magic squares [7]. During 16th century, the Italian and the Japanese mathematicians made an extensive study on the properties of magic squares. Even these days, the study of magic squares is widespread in Tibet and Malaysia, that have close connections with China and India. The conditions