CHAPTER I

INTRODUCTION

A Magic Square is an arrangement of integers in the form of a square in such a manner that the sum of the numbers in each vertical column and horizontal row and in each diagonal is constant. If the integers are the consecutive numbers from 1 to n^2 the square is said to be of the n^{th} order. Unless otherwise stated, we confine our account to magic squares as in the following definition[1].

1.1 Definition. An n^{th} order magic square is a square divided into n^2 cells in which numbers from 1 to n^2 are placed in such a manner that sums of the numbers in all horizontal rows and vertical columns, as well as in both diagonals, are the same.

The common value of these sums is $\frac{n(n^2+1)}{2}$ since the sum of all numbers 1, 2, ..., n^2 amounts to $\frac{n^2(n^2+1)}{2}$.

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[1] Uspensky, J.V. and Heaslet M.A. Elementary Number Theory. (New York: Mc Graw-Hill Book Company, Inc., 1939), p.159.

The following is an example of a magic square of the 7^{th} order in which the common value of the sums is 175.

1	10	19	28	30	39	48
18	27	29	38	47	7	9
35	37	46	6	8	17	26
45	5	14	16	25	34	36
13	15	24	33	42	44	4
23	32	41	43	3	12	21
40	49	2	11	20	22	31

Figure 1.1
A magic square of order 7.

1.2 Magic squares were known to men from the early days of civilization. According to a Chinese legend a magic square was first seen by the Chinese Emperor Yu, in about 2200 B.C., decorating the back of a divine tortoise along a bark of the Yellow River. Originally, magic squares were universally believed to possess astrological qualities. Even to-day they are found among the decorations of Eastern fortunetellers. Magic squares were in old times considered to have been endowed with supernatural properties and powers[2]. They were used as amulets and talismans to ward off illness and evil spirits, and to provide all sorts of protection from disease and misfortune.

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[2]American Corporation. The Encyclopedea Americana vol. 18 (New York: Americana Corporation, 1962), p.122.

During the last few centuries various mathematicians have approached the subject from the standpoint of mathematical recreations. The study of magic squares is the origin of combinatorial mathematics. To-day combinatorial mathematics are basic in the analysis and design of experiments, and they also arise in abstract algebra, topology, game theory, linear programming and in many other areas[3]. It is therefore interesting to try and find a general method for constructing magic squares.

1.3 We are proud to say that the ancient Thai people knew the particular method of constructing any odd order magic square which De la Loubère[4], when envoy of Louis XIV to Thailand in 1687-1688, learned and took back to France. After that time the knowledge of constructing magic squares became widespread in Europe.

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[3]Ryser, Herbert John. Combinatorial Mathematics. (New Jersey: Quinn & Boden Company, Inc., 1963) p.2.

[4]Eves, Howard. An Introduction to the History of Mathematics. (New York: Rinehart, 1953), p.48.

At present, there are numerous particular methods for constructing magic squares[5]. In this thesis we shall try to find a general method for constructing magic squares which includes as many of those particular methods as possible. And we shall also try to find out how many magic squares of any odd order can be constructed by our method.

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[5]Collier's Encyclopedia vol. 13 (New York: C.F. Collier's & son corporation, 1959), pp. 3-5.