CHAPTER I

INTRODUCTION

A <u>Latin square</u> of order n is an arrangement of n objects, say 1,..., n, into a square array in such a way that each object occurs exactly once in every row and every column.

The following are examples of two Latin squares of order 3.

1	2	3
2	3	1
3	1	2

1	2	3
3	1	2
2	3	1

If we superimpose one of these upon the other and form ordered pairs of objects in the corresponding cells, taking objects in the first square as the first entries and objects in the second square as the second entries, we have a square that contains all 9 possible ordered pairs of the objects.

(1,1)	(2,2)	(3,3)
(2,3)	(3,1)	(1,2)
(3,2)	(1,3)	(2,1)

If, by superimposing one upon the other, two Latin squares of order n give rise to all the n^2 ordered pairs of objects, we say that the two Latin squares are orthogonal. The above example is an example of a pair of orthogonal Latin squares of order 3. A set of Latin squares of order n is said to be <u>a set of mutually orthogonal Latin squares</u> of order n if every pair of Latin squares in the set are orthogonal.

This thesis concerns with construction of sets of mutually orthogonal Latin squares. Chapter II deals with construction of sets of mutually orthogonal Latin squares from rings, groups and loops. It will be shown in this Chapter that there can be atmost n-1 mutually orthogonal Latin squares of order n. In Chapter III we characterize a set of n-1 mutually orthogonal Latin squares of order n by a projective plane of order n by proving that the set of n-1 mutually orthogonal Latin squares of order n exists if and only if the projective plane of order n exists.

The problem of construction of a pair of orthogonal Latin squares of any given order was a very old problem. Euler conjectured in 1782 that there exists no pair of orthogonal Latin squares of order $n \equiv 2 \pmod 4$. In 1900, Tarry verified by enumeration that there exists no pair of orthogonal Latin squares of order 6. However, Euler conjecture was disproved in 1959. Chapter IV, V deal with construction of pairs of orthogonal Latin squares. Finally in Chapter VI, it will be proved that we can always construct a pair of orthogonal Latin squares of order $n > 6$.