

## CHAPTER 5

### Conclusion

In this research we obtain the main objectives as the following:

1. We give characteristics of the Lanna Magic Square. The following are the results.

1.1 If let  $l =$ 

$a$	$b$	$c$	$d$
$e$	$f$	$g$	$h$
$i$	$j$	$k$	$l$
$m$	$n$	$o$	$p$

 be a pandiagonal Lanna Magic Square.

And let  $T_1, T_2, T_3, T_4$  and  $T_5$  be transformations of pandiagonal Lanna Magic Square when

$T_1$ : Reflection about the  $a, f, k, p$  diagonal.

$T_2$ : Rotation through  $90^\circ$  counter-clockwise.

$T_3$ : Putting the first column last.

$T_4$ : Putting the first row last.

$T_5$ : The transformation of a pandiagonal Lanna Square  $l$  into

$a$	$d$	$h$	$e$
$b$	$c$	$g$	$f$
$n$	$o$	$k$	$j$
$m$	$p$	$l$	$i$

we know that a pandiagonal Lanna Magic Square remains a pandiagonal Lanna Magic Square after applied transformations  $T_1, T_2, T_3, T_4, T_5$ .

1.2 The four elements of any  $2 \times 2$  subsquare of a pandiagonal Lanna Magic Square add up to 32.

1.3 All pandiagonal Lanna Magic Square, the sum of any element and the element that is two distant from it along a diagonal is 16. (This include main diagonals and broken diagonals.)

1.4 All pandiagonal Lanna Magic Squares can be derived from a single one (the Lanna magic square) by successive transformations of  $T_1, T_2, T_3, T_4$  and  $T_5$ .

2. We obtain the total number of pandiagonal Lanna Magic Squares by using a concept of abstract algebra, a group action on subgroup of  $S_{16}$ .

First, we show that the order of subgroup of  $S_{16}$  generated by  $T_1, T_2, T_3, T_4, T_5$  is 384.

Then we use a concept of abstract algebra, a group action to conclude that there are 384 pandiagonal Lanna Magic Squares.

3. we generate all Lanna Magic Squares, pandiagonal Lanna Magic Squares and semi-pandiagonal Lanna Magic Squares using mathematical program (Scilab). The following are the results.

3.1 For Lanna Magic Squares, we obtain 8,512 unique of Lanna Magic Squares.

3.2 For pandiagonal Lanna Magic Squares, we obtain 384 unique of pandiagonal Lanna Magic Squares.

3.3 For semi-pandiagonal Lanna Magic Squares, we obtain 3,072 unique of semi-pandiagonal Lanna Magic Squares.



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