View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Universiti Teknologi Malaysia Institutional Repository

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	THESIS STATUS DECLARATION	
	SUPERVISOR'S DECLARATION	
	TITLE PAGE	i
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	x
	LIST OF FIGURES	xi
	LIST OF SYMBOLS	xiii
1	**INTRODUCTION**	
	1.1 Background of Research	1
	1.2 Statement of Problem	2
	1.3 Objectives of Research	4
	1.4 Scope of Research	4
	1.5 Importance of Research	5
	1.6 Framework of Research	5

2 LITERATURE REVIEW

2.1 Introduction 8
2.2 Fuzzy Topographic Topological Mapping (FTTM) 8
2.2.1 FTTM 1 and FTTM 2 11
2.2.2 Characteristics of FTTM 13
2.2.3 Generalized FTTM 15
2.3 Fibonacci Cube 17
2.4 Pascal's Triangle 19
2.4.1 Patterns in Pascal's Triangle 22
2.5 Conclusion 27

3 A CONSTRUCTIVE PROOF FOR GENERATING FTTM

3.1 Introduction 28
3.2 Axiomatic System 28
3.3 Proving Methods 30
3.3.1 Exhaustion 31
3.3.2 Direct 32
3.3.3 Contradiction 33
3.3.4 Contrapositive 34
3.3.5 Mathematical Induction 34
3.3.6 Constructive 35
3.4 Conclusion 36

4 A SEQUENCE OF FTTM

4.1 Introduction 37
4.2 Geometrical Features of FTTM 37
4.3 Formal Definitions 45
4.4 A Sequence of FTTM 47

4.5 A Sequence of Cubes in $FTTM_n$ 49
4.6 "Extended Cubes" in $FTTM_n$ 57
4.7 Conclusion 76

5 A SEQUENCE OF FTTM IN RELATION TO PASCAL'S TRIANGLE

5.1 Introduction 77
5.2 The Relation of A Sequence of FTTM to Pascal's Triangle 78
5.3 The Proof of Li Yun's Conjecture 80
5.4 Further Results 83
5.5 Coefficients of FTTM and F5 95
5.6 Relating Extension Results of FTTM to Pascal's Triangle 100
5.7 A Sequence of Polygon 103
5.8 Conclusion 107

6 CONCLUSION

6.1 Summary 108
6.2 Suggestions for Further Research 109

REFERENCES 110

LIST OF TABLES

TABLE NO.	TITLE	PAGE
2.1	Polygonal Number	26
4.1	Geometrical features of combined FTTM	40
4.2	Geometrical features of sequences of $FTTM_1$ until $FTTM_{20}$	44
4.3	Cube with two terms FTTM in $FTTM_n$	49
4.4	Samples of sequence of $FTTM_{2/n}$	56
4.5	Cube with three terms FTTM in $FTTM_n$	57
4.6	Samples of sequence of $FTTM_{3/n}$	68
4.7	Cube with four terms FTTM in $FTTM_n$	69
4.8	Samples of sequence of $FTTM_{4/n}$	74
4.9	A Comparison between generating $FTTM_n$ and conjecture made by Liau Li Yun (2006)	76
5.1	Two terms of F2 in $F2_n$	86
5.2	Two terms of F3 in $F3_n$	88
5.3	Three terms of F3 in $F3_n$	89
5.4	Two, three, four and five terms of F5 in $F5_n$	92
5.5	A Sequence of Polygon	105

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
1.1	Model of FTTM	2
1.2	Homeomorphisms between FTTM 1 and FTTM 2	3
1.3	Framework of research	7
2.1	Human Brain	9
2.2	MEG System	10
2.3	FTTM Version 1	11
2.4	FTTM Version 2	12
2.5	Homeomorphism from $\boldsymbol{S}^2$ to $\boldsymbol{E}^2$	13
2.6	Equivalence of components of FTTM Version 1	13
2.7	Homeomorphism between corresponding components of FTTM 1 and FTTM 2	14
2.8	$FTTM_n$	16
2.9	Extended Fibonacci Cubes EFC_1s	18
2.10	Modified $EFC_1(5)$	18
2.11	Reconstruct $EFC_1(5)$	18
2.12	Chinese Pascal's Triangle	20
2.13	The original Pascal's Triangle	20
2.14	Present-day Pascal's Triangle	21
2.15	Hockey stick in Pascal's Triangle	23
2.16	Fibonacci's Sequence in Pascal's Triangle	24
2.17	Triangular numbers in Pascal's Triangle	24
2.18	Square number in Pascal's Triangle	25

4.1	A Sequence of $FTTM_n$	47
4.2	$FTTM_{2/4}$	55
4.3	$FTTM_{3/4}$	67
4.4	$FTTM_{4/5}$	73
5.1	The Nonzero Sequence of $FTTM_{2/n}$, $FTTM_{3/n}$ and $FTTM_{4/n}$	78
5.2	An Alternative Version of Pascal's Triangle	79
5.3	$FTTM_n$	82
5.4	A Sequence of F2	83
5.5	A Sequence of F3	84
5.6	A Sequence of F5	84
5.7	A Sequence of F*k*	85
5.8	Relating Extension Result to Pascal's Triangle	101
5.9	The Triangle of Coefficients	103

LIST OF SYMBOLS

$\cong$	-	Homeomorphism
$\leq$	-	Less than or equal
$\geq$	-	Greater than or equal
$>$	-	Greater than
$\|\|$	-	Concatenation operation
$\Rightarrow$	-	Implies
~P	-	Not P
$\in$	-	Element of
$\|\ \ \|$	-	Number of elements in a set