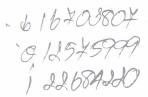


Inductive Approach to Recognition, Analysis and Formulations of Patterns

Michael A Radin





Analyzing Mathematical Patterns – Detection & Formulation

Inductive Approach to Recognition, Analysis and Formulations of Patterns



Michael A Radin

Rochester Institute of Technology, USA



Contents

Pre	face		V		
Abc	About the Author				
Ack	enowled	lgments	ix		
1.	Intro	eduction to Patterns	1		
	1.1	Geometrical Arrangements	4		
	1.2	Piecewise Functions	7		
	1.3	Analytical Formulations	13		
		1.3.1 Geometric Sequences and Paper Folding	17		
	1.4	Recursive Sequences	18		
		1.4.1 Summation-type Sequences	19		
		1.4.2 The Fibonacci Sequence	21		
		1.4.3 Product-Type Sequences	23		
	1.5		25		
	1.6	Periodic Cycles	27		
		1.6.1 Shapes of Periodic Cycles	30		
	1.7	Exercises	32		
2.	Geor	metrical Configurations	37		
	2.1	Patterns at Same Scale	39		
		2.1.1 Piecewise Functions	41		
		2.1.2 Geometrical Structures	45		
	2.2	Patterns at Different Scales	49		
		2.2.1 Diminishing Geometrical Patterns	51		

Analyzing I	Mathematical	Patterns	- $Detection$	$\mathcal{E}_{\mathcal{S}}$	Formulation
-------------	--------------	----------	---------------	-----------------------------	-------------

xii

	2.3	Alternating and Piecewise Patterns 65 2.3.1 Alternating Geometrical Patterns 65
	2.4 2.5	Summation of Areas
3.	Sequ	ences, Products and Summations 93
	3.1 3.2 3.3 3.4 3.5	Linear Sequences
4.	•	mations and Proof by Induction 113
	4.1 4.2 4.3	Linear and Geometric Summations
5.	Trait	s of Pascal's Triangle 123
	5.1 5.2 5.3 5.4	Horizontal Identities1275.1.1 Additional Horizontal Identities131Diagonal Identities134Binomial Expansion138Exercises140
6.	Recu	rsive Relations 143
	6.1 6.2 6.3	Formulating a Recursive Relation
	6.4	Exercises
7.	Perio	odic Traits 165
	7.1 7.2	Autonomous Recursive Sequences

Contents	xiii
00111011110	

	7.3	Additive Form of Eq. (7.1)
		7.3.1 Special Case of Additive Form of Eq. (7.1)
		7.3.2 $\{b_n\}_{n=0}^{\infty}$ is an Odd-Ordered Periodic
		Sequence $\dots \dots \dots$
		7.3.3 $\{b_n\}_{n=0}^{\infty}$ is an Even-Ordered Periodic
		Sequence
	7.4	Additive and Multiplicative Forms of Eq. (7.1) 189
		7.4.1 $\{a_n\}_{n=0}^{\infty}$ and $\{b_n\}_{n=0}^{\infty}$ are the Same Period
		7.4.2 $\{a_n\}_{n=0}^{\infty}$ and $\{b_n\}_{n=0}^{\infty}$ are Different
		Periods
	7.5	Special Case of Eq. (7.1)
	7.6	Exercises
8.	Answ	vers to Chapter Exercises 205
	8.1	Answers to Chapter 1 Exercises
	8.2	Answers to Chapter 2 Exercises
	8.3	Answers to Chapter 3 Exercises
	8.4	Answers to Chapter 4 Exercises
	8.5	Answers to Chapter 5 Exercises
	8.6	Answers to Chapter 6 Exercises
	8.7	Answers to Chapter 7 Exercises
9.	Appe	endices 219
	9.1	Right Triangles
	9.2	Isosceles Triangle
	9.3	Equilateral Triangle
	9.4	Area of Figures
	9.5	Patterns (Sequences)
	9.6	Alternating Patterns (Sequences)
	9.7	Summation Properties
	9.8	Finite Summations
	9.9	Laws of Exponents
	9.10	Factoring Methods
	9.11	Binomial Expansion
Bib	liograp	hy 23
Ind	ex	23