Contents

Prefa	ace viii	
_	nter 0 RODUCTION	1
	nods for Semantics Specification 2 gested Readings 3	
-	oter 1 TAX	5
1.2 Sugg	Abstract Syntax Definitions 9 Mathematical and Structural Induction 12 gested Readings 15 rcises 15	
-	oter 2 S, FUNCTIONS, AND DOMAINS	17
2.1	Sets 17 2.1.1 Constructions on Sets 18 Functions 20	
2.3	2.2.1 Representing Functions as Sets 21 2.2.2 Representing Functions as Equations 24 Semantic Domains 25	
Sugg	2.3.1 Semantic Algebras 25 gested Readings 27 rcises 27	
	oter 3 MAIN THEORY I: SEMANTIC ALGEBRAS	30
3.1 3.2	Primitive Domains 30 Compound Domains 34 3.2.1 Product 34 3.2.2 Disjoint Union 35 3.2.3 Function Space 39 3.2.4 Lifted Domains and Strictness 42	

•	<u> </u>
IV	Contents

3.3 3.4	Recursive Function Definitions 44 Recursive Domain Definitions 46
3.5	Summary 46
	ested Readings 48
Exer	
Chap	ter 4
-	IC STRUCTURE OF DENOTATIONAL DEFINITIONS 54
4.1	The Valuation Function 54
4.2	Format of a Denotational Definition 57
4.3	A Calculator Language 59
	ested Readings 63
Exer	cises 63
Chap	ter 5
	ERATIVE LANGUAGES 66
5.1	A Language with Assignment 66
<i>-</i> -	5.1.1 Programs are Functions 72
5.2	An Interactive File Editor 73
5.3	5.2.1 Interactive Input and Partial Syntax 78 A Dynamically Typed Language with Input and Output 80
5.4	A Dynamically Typed Language with Input and Output 80 Altering the Properties of Stores 82
J . 4	5.4.1 Delayed Evaluation 82
	5.4.2 Retaining Multiple Stores 86
	5.4.3 Noncommunicating Commands 87
Sugg	ested Readings 88
Exer	
C_{i}	
Chap	IAIN THEORY II: RECURSIVELY DEFINED FUNCTIONS 94
DON	IAIN THEORY II. RECURSIVELY DEFINED FUNCTIONS 94
6.1	Some Recursively Defined Functions 95
6.2	Partial Orderings 98
6.3	Continuous Functions 102
6.4	Least Fixed Points 103
6.5	Domains are Cpos 104
6.6	Examples 109
	6.6.1 Factorial Function 109
	6.6.2 Copyout Function 110
	6.6.3 Double Recursion 111
	6.6.4 Simultaneous Definitions 111

	6.6.5	1	
	6.6.6	C	
6.7		ning about Least Fixed Points 117	
		radings 119	
Exer	cises	120	
Chai	oter 7		
		ES WITH CONTEXTS	125
7.1		ck-Structured Language 127	
	7.1.1	Stack-Managed Storage 134	
	7.1.2		
7.2	_	oplicative Language 137	
	7.2.1	1 0	
	7.2.2	**	
		Recursive Declarations 145	
7.3		ound Data Structures 148	
00	ested Red	radings 154	
Exer	cises	154	
	oter 8		
ABS	TRACT	TION, CORRESPONDENCE, AND QUALIFICATION	160
8.1	Abstra	action 161	
0.1	8.1.1	Recursive Bindings 164	
8.2		neterization 165	
0.2		Polymorphism and Typing 167	
8.3		spondence 170	
8.4		fication 171	
8.5	_	gonality 173	
	_	eadings 174	
		174	
LACI	Cises .	1/7	
Chap	oter 9		
CON	NTROL A	AS A SEMANTIC DOMAIN	178
9.1	Contin	nuations 178	
	9.1.1	Other Levels of Continuations 181	
9.2	Except	tion Mechanisms 182	
9.3	Backtr	racking Mechanisms 183	
9.4	Corout	tine Mechanisms 183	
9.5	Unrest	tricted Branching Mechanisms 187	

	The Relationship between Direct and Continuation Semantics 193 sted Readings 195 ses 195	
Chapte IMPL	er 10 EMENTATION OF DENOTATIONAL DEFINITIONS	199
10.1	A General Method of Implementation 199 10.1.1 The SIS and SPS Systems 200	
10.2	Static Semantics Processing 201	
10.3	The Structure of the Evaluator 203	
	10.3.1 A Stack-Based Evaluator 204	
10.4	10.3.2 PSP and Appel's System 208 Combinator-Based Semantic Notations 209	
10.4	Combinator-Based Semantic Notations 209 10.4.1 The Plumb and CERES Systems 211	
10.5	Transformations on the Semantic Definition 212	
10.5	10.5.1 First-Order Data Objects 212	
	10.5.2 Global Variables 214	
	10.5.3 Control Structures 217	
10.6	Implementation of Continuation-Based Definitions 218	
10.0	10.6.1 The CGP and VDM Methods 222	
10.7	Correctness of Implementation and Full Abstraction 223	
	sted Readings 225	
Exerci		
2,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
Chapte	er 11	
DOM	AIN THEORY III: RECURSIVE DOMAIN SPECIFICATIONS	230
11.1	Reflexive Domains Have Infinite Elements 230	
11.2		
11.3	Applications 241	
11.5	11.3.1 Linear Lists 242	
	11.3.2 Self-Applicative Procedures 243	
	11.3.3 Recursive Record Structures 244	
Sugges	sted Readings 245	
Exerci	8	
Chapte	er 12	
-	DETERMINISM AND CONCURRENCY	250
12.1	Powerdomains 251	
12.2	The Guarded Command Language 251	

12.3	Concurrency and Resumption Semantics			
12.4	An Alternative Semantics for Concurrency			
12.5	The Powerdomain Structure 265			
	12.5.1	Discrete Powerdomains 266		
	12.5.2	General Powerdomains 268		
Suggest	ted Readin	gs 274		
Exercis	es 274			

Bibliography 217