Contents

Foreword to the English Translation	ix
Denis Artem'evich Vladimirov (1929–1994)	xi
Preface	xvii
Introduction	xix

Part I GENERAL THEORY OF BOOLEAN ALGEBRAS

0.	PRI	ELIMINARIES ON BOOLEAN ALGEBRAS	3
	1	Lattices	3
	2	Boolean algebras	10
	3	Additive functions on Boolean algebras. Measures. Relation to probability theory	23
	4	Automorphisms and invariant measures	29
1.	THI	E BASIC APPARATUS	35
	1	Subalgebras and generators	35
	2	The concepts of ideal, filter, and band	48
	3	Factorization, homomorphisms, independence, and free Boolean algebras	55
2.	COI	MPLETE BOOLEAN ALGEBRAS	83
	1	Complete Boolean algebras; their subalgebras and homomorphisms	83
	2	The exhaustion principle and the theorem of solid cores	89
	3	Construction of complete Boolean algebras	95
	4	Important examples of complete Boolean algebras	102
	5	The Boolean algebra of regular open sets	103

	6	The type, weight, and cardinality of a complete Boolean algebra	105
	7	Structure of a complete Boolean algebra	111
3.	REF	PRESENTATION OF BOOLEAN ALGEBRAS	125
	1	The Stone Theorem	125
	2	Interpretation of the basic notions of the theory of Boolean algebras in the language of Stone spaces	136
	3	Stone functors	150
4.	TOI	POLOGIES ON BOOLEAN ALGEBRAS	181
	1	Directed sets and generalized sequences	181
	2	Various topologies on Boolean algebras	184
	3	Regular Boolean algebras. Various forms of distributivity	223
5.	HOI	MOMORPHISMS	233
	1	Extension of homomorphisms	234
	2	Lifting	238
	3	Extension of continuous homomorphisms	244
	4	Again on representation of a Boolean algebra	267
6.	VEC	CTOR LATTICES AND BOOLEAN ALGEBRAS	277
	1	K-spaces and the related Boolean algebras	277
	2	Spectral families and resolutions of the identity. Spectral measures	287
	3	Separable Boolean algebras and σ -algebras of sets. Measurable functions	296
	4	The integral with respect to a spectral measure and the Freudenthal Theorem. The space $\mathfrak{S}_{\mathscr{X}}$ as the family of resolutions of the identity. Functions of elements	298
Pa	rt II	METRIC THEORY OF BOOLEAN ALGEBRAS	
7.	NOI	RMED BOOLEAN ALGEBRAS	317
	1	Normed algebras	317
	2	Extension of a countably additive function. The Lebesgue–Carathéodory Theorem	325
	3	NBAs and the metric structures of measure spaces	332
	4	Totally additive functions and resolutions of the identity of a normed algebra	342
	5	Subalgebras of a normed Boolean algebra	353
	6	Fundamental systems of partitions	382
	7	Systems of measures and the Lyapunov Theorem	387

Contents			vii	
8.	EXI	STENCE OF A MEASURE	391	
	1	Conditions for existence of a measure	391	
	2	Existence of a measure invariant under		
		the automorphism group	399	
	3	The Potepun Theorem	417	
	4	Automorphisms of normable algebras and invariant measures	433	
	5	Construction of a normed Boolean algebra given a transformation group	439	
9.	STF	RUCTURE OF		
	A N	ORMED BOOLEAN ALGEBRA	445	
	1	Structure of a normed algebra	445	
	2	Classification for normed algebras	464	
	3	Interlocation of subalgebras of a normed Boolean algebra	470	
	4	Isomorphism between subalgebras	475	
	5	Isomorphism of systems of subalgebras	531	
10. INDEPENDENCE		535		
	1	A system of two subalgebras	535	
	2	A test for metric independence	541	
Aŗ	Appendices		562	
Prerequisites to Set Theory and General Topology 5			563	
	1	General remarks	563	
	2	Partially ordered sets	564	
	3	Topologies	565	
	Basi	cs of Boolean Valued Analysis	569	
	1	General remarks	569	
	2	Boolean valued models	569	
	3	Principles of Boolean valued analysis	571	
	4	Ascending and descending	572	
References				
			581	

Index

601

Foreword to the English Translation

I am deeply honored to introduce this great book of a great author to the English language reading community.

Denis Artem' evich Vladimirov (1929–1994) was a prominent representative of the Russian mathematical school in functional analysis which was founded by Leonid Vital' evich Kantorovich, a renowned mathematician and a Nobel Prize winner in economics.

This school comprises two affiliations in St. Petersburg and Novosibirsk which maintain intimate relations since the latter was set up by the former, so it is not astonishing that I enjoyed the wit and charm of Vladimirov for many years.

Our contacts were usually established through the students we supervised; he, in St. Petersburg and I, in Novosibirsk. I always tried to arrange matters so that my students spent some time near Vladimirov to master Boolean algebras and ordered vector spaces. Probably one of the results of this cooperation is the fact that there is now an active group in Boolean valued analysis in Novosibirsk. Unfortunately, the only possibility of continuing this practice is offered by the present book...

It was not long before Vladimirov's death when he and his friends had asked me to help with the publishing and editing of the English translation of the book. I agreed readily and soon Kluwer Academic Publishers decided to print the book.

The book was mostly translated by Professor A. E. Gutman and his students in Novosibirsk, all "descendants" of Vladimirov.

E. G. Taĭpale translated a few final sections and made the entire book more readable. I. I. Bazhenov, I. I. Kozhanova, Yu. N. Lovyagin, A. A. Samorodnitskiĭ, and Yu. V. Shergin helped me with the proofreading. The translation took much more time than planned: the reasons behind this are understandable for anyone aware of the present standards of academic life in Russia. Unfortunately, capable mathematicians are not always experienced translators and knowledgeable grammarians. Therefore, the battle against solecism and mistranslation was partly lost in proofreading...

Vladimirov was unhappy that he had no opportunity to include a chapter on Boolean valued analysis in this edition of his book. At the publisher's request, I compiled a short appendix which is intended to serve as an introduction to this new and promising area for expansion and proliferation of Boolean algebras.

Denis Artem'evich Vladimirov was one of the giants of the past who bequeathed us his insight into part of the future with this book. I hope the reader will enjoy it.

S. S. Kutateladze

August, 2001