
Contents

Preface	xi
Chapter 1. Fundamental Facts	1
§1.1. Notation	1
§1.2. C^* -algebras	2
§1.3. Von Neumann algebras	3
§1.4. Double duals	5
§1.5. Completely positive maps	9
§1.6. Arveson's Extension Theorem	17
§1.7. Voiculescu's Theorem	18
Part 1. Basic Theory	
Chapter 2. Nuclear and Exact C^* -Algebras: Definitions, Basic Facts and Examples	25
§2.1. Nuclear maps	25
§2.2. Nonunital technicalities	28
§2.3. Nuclear and exact C^* -algebras	32
§2.4. First examples	38
§2.5. C^* -algebras associated to discrete groups	42
§2.6. Amenable groups	48
§2.7. Type I C^* -algebras	55
§2.8. References	58
Chapter 3. Tensor Products	59

§3.1. Algebraic tensor products	59
§3.2. Analytic preliminaries	66
§3.3. The spatial and maximal C^* -norms	72
§3.4. Takesaki's Theorem	77
§3.5. Continuity of tensor product maps	82
§3.6. Inclusions and The Trick	85
§3.7. Exact sequences	92
§3.8. Nuclearity and tensor products	99
§3.9. Exactness and tensor products	105
§3.10. References	112
Chapter 4. Constructions	115
§4.1. Crossed products	115
§4.2. Integer actions	121
§4.3. Amenable actions	124
§4.4. $X \rtimes \Gamma$ -algebras	129
§4.5. Compact group actions and graph C^* -algebras	133
§4.6. Cuntz-Pimsner algebras	136
§4.7. Reduced amalgamated free products	154
§4.8. Maps on reduced amalgamated free products	157
§4.9. References	165
Chapter 5. Exact Groups and Related Topics	167
§5.1. Exact groups	167
§5.2. Groups acting on trees	176
§5.3. Hyperbolic groups	182
§5.4. Subgroups of Lie groups	193
§5.5. Coarse metric spaces	194
§5.6. Groupoids	200
§5.7. References	209
Chapter 6. Amenable Traces and Kirchberg's Factorization Property	211
§6.1. Traces and the right regular representation	211
§6.2. Amenable traces	214
§6.3. Some motivation and examples	223
§6.4. The factorization property and Kazhdan's property (T)	227
§6.5. References	235

Chapter 7. Quasidiagonal C^* -Algebras	237
§7.1. The definition, easy examples and obstructions	237
§7.2. The representation theorem	243
§7.3. Homotopy invariance	247
§7.4. Two more examples	252
§7.5. External approximation	255
§7.6. References	260
Chapter 8. AF Embeddability	261
§8.1. Stable uniqueness and asymptotically commuting diagrams	261
§8.2. Cones over exact RFD algebras	267
§8.3. Cones over general exact algebras	268
§8.4. Homotopy invariance	274
§8.5. A survey	279
§8.6. References	282
Chapter 9. Local Reflexivity and Other Tensor Product Conditions	283
§9.1. Local reflexivity	284
§9.2. Tensor product properties	285
§9.3. Equivalence of exactness and property C	293
§9.4. Corollaries	297
§9.5. References	299
Chapter 10. Summary and Open Problems	301
§10.1. Nuclear C^* -algebras	301
§10.2. Exact C^* -algebras	303
§10.3. Quasidiagonal C^* -algebras	306
§10.4. Open problems	309
Part 2. Special Topics	
Chapter 11. Simple C^* -Algebras	313
§11.1. Generalized inductive limits	313
§11.2. NF and strong NF algebras	317
§11.3. Inner quasidiagonality	323
§11.4. Excision and Popa's technique	328
§11.5. Connes's uniqueness theorem	335
§11.6. References	337

Chapter 12. Approximation Properties for Groups	339
§12.1. Kazhdan's property (T)	339
§12.2. The Haagerup property	354
§12.3. Weak amenability	361
§12.4. Another approximation property	369
§12.5. References	374
Chapter 13. Weak Expectation Property and Local Lifting Property	375
§13.1. The local lifting property	375
§13.2. Tensorial characterizations of the LLP and WEP	378
§13.3. The QWEP conjecture	380
§13.4. Nonsemisplit extensions	385
§13.5. Norms on $\mathbb{B}(\ell^2) \odot \mathbb{B}(\ell^2)$	388
§13.6. References	391
Chapter 14. Weakly Exact von Neumann Algebras	393
§14.1. Definition and examples	393
§14.2. Characterization of weak exactness	397
§14.3. References	403
Part 3. Applications	
Chapter 15. Classification of Group von Neumann Algebras	407
§15.1. Subalgebras with noninjective relative commutants	407
§15.2. On bi-exactness	411
§15.3. Examples	414
§15.4. References	420
Chapter 16. Herrero's Approximation Problem	421
§16.1. Description of the problem	421
§16.2. C^* -preliminaries	423
§16.3. Resolution of Herrero's problem	425
§16.4. Counterexamples	426
§16.5. References	429
Chapter 17. Counterexamples in K-Homology and K-Theory	431
§17.1. BDF preliminaries	431
§17.2. Property (T) and Kazhdan projections	435
§17.3. Ext need not be a group	438

§17.4. Topology on Ext	439
§17.5. References	441
Part 4. Appendices	
Appendix A. Ultrafilters and Ultraproducts	445
Appendix B. Operator Spaces, Completely Bounded Maps and Duality	449
Appendix C. Lifting Theorems	459
Appendix D. Positive Definite Functions, Cocycles and Schoenberg's Theorem	463
Appendix E. Groups and Graphs	471
Appendix F. Bimodules over von Neumann Algebras	479
Bibliography	493
Notation Index	503
Subject Index	505