

CONTENTS

CONTENTS	
1 Definitions and Examples	1
1.1 Right partially ordered groups	1
1.2 Partially ordered groups	2
1.3 Examples	2
2 Basic Properties	15
2.1 Basic group-theoretic properties	15
2.2 Orderability	18
2.3 Basic order-theoretic properties	20
2.4 Characterisations of classes	24
3 Values, Primes and Polars	31
3.1 Values	31
3.2 Homomorphisms	34
3.3 Prime subgroups	36
3.4 Special values	39
3.5 Polars	41
3.6 Closed subgroups	44
3.7 A limiting example	49
3.8 Residually ordered groups	51
3.9 Finite pairwise orthogonal sets	53
4 Abelian and Normal-valued Lattice-ordered Groups	55
4.1 Simple Abelian lattice-ordered groups	55
4.2 Normal-valued lattice-ordered groups	58
4.3 Special-valued lattice-ordered groups	63
4.4 Archimedean lattice-ordered groups	65
4.5 Hahn's Theorem	69

4.6	The Conrad-Harvey-Holland Theorem	73
4.7	Elementary theory (Abelian ℓ -groups)	75
5	Archimedean Function Groups	87
5.1	Free Abelian lattice-ordered groups	87
5.2	Finitely presented Abelian ℓ -groups	88
5.3	The Isomorphism Problem	91
5.4	Free products of Abelian ℓ -groups	92
5.5	Kaplansky's Example	94
5.6	Bernau's Theorem	95
5.7	The Spectrum	103
5.8	Hyperarchimedean ℓ -groups	104
6	Soluble Right Partially Ordered Groups & Generalisations	107
6.1	Nilpotent lattice-ordered groups	107
6.2	The Engel Condition	109
6.3	The Word Problem	113
6.4	Weakly Abelian ℓ -groups	116
6.5	Divisibility	118
6.6	Conrad right orders	120
6.7	Local nilpotency	123
6.8	4-Engel right ordered groups	124
6.9	Local indicability	127
6.10	Two sided right orders	133
7	Permutations	139
7.1	The Cayley-Holland Theorem	139
7.2	Amalgamation	144
7.3	Convex blocks and congruences	145
7.4	Primitive permutation groups	146
7.5	Primitive components	154
7.6	The Wreath product	156
8	Applications	163
8.1	Normal-valued ℓ -permutation groups	163
8.2	Nilpotent relations and soluble identities	165
8.3	Conjugacy	169

8.4	Free lattice-ordered groups	170
8.5	Free products of ℓ -groups	175
8.6	Simple lattice-ordered groups	177
8.7	Finitely presented ℓ -groups	182
8.8	Undecidable Problems	184
9	Completions	191
9.1	Complete partially ordered groups	191
9.2	ℓ -convergence structures	195
9.3	The Order completion	199
9.4	Special closure	204
9.5	Iterated Cauchy closure	206
9.6	The lateral completion	209
9.7	The distinguished completion	214
10	Varieties of Lattice-ordered Groups	227
10.1	Definitions and Examples	227
10.2	General facts	229
10.3	Minimal & maximal proper varieties	230
10.4	Socle	232
10.5	Powers of \mathcal{A}	235
10.6	Dimension theory	238
10.7	Powers of \mathcal{R}	240
10.8	Covers of \mathcal{A}	247
10.9	The number of varieties	258
11	Unsolved Problems	261
REFERENCES		267
FURTHER SUGGESTED READING		275
LIST OF SYMBOLS		299
INDEX		301

Note that, if G is a right partially ordered group, then the order is completely determined by $G^+ = \{g \in G : g \geq 1\}$, since $f \leq g$ if and only if $1 \leq g/f^{-1}$. We call G^+ the set of positive elements of G . Similarly, if G is a left partially ordered group, then the order is completely determined by G^+ .