



Contents

<i>Preface</i>	<i>page ix</i>
1 Motivating Examples	1
2 Abstract Reduction Systems	7
2.1 Equivalence and reduction	7
2.2 Well-founded induction	13
2.3 Proving termination	16
2.4 Lexicographic orders	18
2.5 Multiset orders	21
2.6 Orders in ML	26
2.7 Proving confluence	28
2.8 Bibliographic notes	33
3 Universal Algebra	34
3.1 Terms, substitutions, and identities	34
3.2 Algebras, homomorphisms, and congruences	44
3.3 Free algebras	47
3.4 Term algebras	49
3.5 Equational classes	49
4 Equational Problems	58
4.1 Deciding \approx_E	59
4.2 Term rewriting systems	61
4.3 Congruence closure	62
4.4 Congruence closure on graphs	65
4.5 Syntactic unification	71
4.6 Unification by transformation	73
4.7 Unification and term rewriting in ML	79
4.8 Unification of term graphs	82
4.9 Bibliographic notes	91

5	Termination	93
5.1	The decision problem	93
5.2	Reduction orders	101
5.3	The interpretation method	104
5.4	Simplification orders	111
5.5	Bibliographic notes	131
6	Confluence	134
6.1	The decision problem	134
6.2	Critical pairs	135
6.3	Orthogonality	145
6.4	Beyond orthogonality	151
6.5	Bibliographic notes	157
7	Completion	158
7.1	The basic completion procedure	160
7.2	An improved completion procedure	164
7.3	Proof orders	172
7.4	Huet's completion procedure	178
7.5	Huet's completion procedure in ML	182
7.6	Bibliographic notes	184
8	Gröbner Bases and Buchberger's Algorithm	187
8.1	The ideal membership problem	187
8.2	Polynomial reduction	189
8.3	Gröbner bases	193
8.4	Buchberger's algorithm	196
8.5	Bibliographic notes	198
9	Combination Problems	200
9.1	Basic notions	200
9.2	Termination	202
9.3	Confluence	207
9.4	Combining word problems	211
9.5	Bibliographic notes	222
10	Equational Unification	223
10.1	Basic definitions and results	224
10.2	Commutative functions	230
10.3	Associative and commutative functions	236
10.4	Boolean rings	250
10.5	Bibliographic notes	262

11 Extensions	265
11.1 Rewriting modulo equational theories	265
11.2 Ordered rewriting	267
11.3 Conditional identities and conditional rewriting	269
11.4 Higher-order rewrite systems	270
11.5 Reduction strategies	271
11.6 Narrowing	273
<i>Appendix 1 Ordered Sets</i>	276
<i>Appendix 2 A Bluffer's Guide to ML</i>	278
<i>Bibliography</i>	284
<i>Index</i>	297