

Contents

Introduction	ix
I Algebras and modules	1
1 Algebras	1
2 Representations of algebras and modules	12
3 The Jacobson radical	30
4 The Krull–Schmidt theorem	41
5 Semisimple modules	45
6 Semisimple algebras	56
7 The Jordan–Hölder theorem	67
8 Projective and injective modules	73
9 Hereditary algebras	93
10 Nakayama algebras	100
11 The Grothendieck group and the Cartan matrix	105
12 Exercises	109
II Morita theory	123
1 Categories and functors	123
2 Bimodules	125
3 Tensor products of modules	133
4 Adjunctions and natural isomorphisms	140
5 Progenerators	151
6 Morita equivalence	157
7 Morita–Azumaya duality	175
8 Exercises	188
III Auslander–Reiten theory	203
1 The radical of a module category	203
2 The Harada–Sai lemma	207
3 The space of extensions	209
4 The Auslander–Reiten translations	232
5 The Nakayama functors	247
6 The Auslander–Reiten formulas	252
7 Irreducible and almost split homomorphisms	257
8 Almost split sequences	269
9 The Auslander–Reiten quiver	282
10 The Auslander theorem	301

11	The Bautista–Smalø theorem	312
12	Exercises	314
IV	Selfinjective algebras	332
1	The Frobenius theorem	332
2	The Brauer–Nesbitt–Nakayama theorems	336
3	Frobenius algebras	345
4	Symmetric algebras	355
5	Simple algebras	368
6	The Nakayama theorems	375
7	Non-Frobenius selfinjective algebras	386
8	The syzygy functors	392
9	The higher extension spaces	402
10	Periodic modules	414
11	Periodic algebras	427
12	The Green–Snashall–Solberg theorems	442
13	Dynkin and Euclidean graphs	447
14	Canonical mesh algebras of Dynkin type	452
15	The Riedtmann–Todorov theorem	455
16	Exercises	470
V	Hecke algebras	489
1	Finite reflection groups	489
2	Coxeter graphs	499
3	The Coxeter theorems	507
4	The Iwahori theorem	515
5	Hecke algebras	528
6	Exercises	533
VI	Hopf algebras	539
1	Coalgebras	539
2	Hopf algebras	552
3	The Larson–Sweedler theorems	584
4	The Radford theorem	595
5	The Fischman–Montgomery–Schneider formula	609
6	The module category	616
7	Exercises	630
	Bibliography	637
	Index	645