

CONTENTS

<i>Preface</i>	<i>page</i> vii
<i>Notes for the reader</i>	ix
1. The language of functors	
1.1 Notation	1
1.2 Bimodules	1
1.3 Covariant functors	1
1.4 Contravariant functors	8
1.5 Additional structure	11
1.6 Bifunctors	12
1.7 Equivalent functors	14
<i>Solutions to the Exercises on Chapter 1</i>	16
<i>Supplementary Exercises on Chapter 1</i>	21
2. The Hom functor	
2.1 Notation	23
2.2 The Hom functor	23
2.3 Projective modules	26
2.4 Injective modules	30
2.5 Injective Z -modules	32
2.6 Essential extensions and injective envelopes	35
<i>Solutions to the Exercises on Chapter 2</i>	38
3. A derived functor	
3.1 Notation	53
3.2 A basic isomorphism	53
3.3 Some remarks on diagrams	62
3.4 The Ker–Coker sequence	62
3.5 Further properties of Ext_Λ^1	66
3.6 Consequences of the vanishing of $\text{Ext}_\Lambda^1(A, B)$	71
3.7 Projective and injective dimension	76

vi	CONTENTS	
3.8	Λ -sequences	<i>page</i> 81
3.9	The extension problem	83
	<i>Solutions to the Exercises on Chapter 3</i>	87
4.	Polynomial rings and matrix rings	
4.1	General	105
4.2	The polynomial functor	105
4.3	Generators of a category	109
4.4	Equivalent categories	112
4.5	Matrix rings	120
	<i>Solutions to the Exercises on Chapter 4</i>	127
5.	Duality	
5.1	General remarks	135
5.2	Noetherian and Artinian conditions	136
5.3	Preliminaries concerning duality	139
5.4	Annihilators	144
5.5	Duality in Noetherian rings	149
5.6	Perfect duality and Quasi-Frobenius rings	152
5.7	Group rings as Quasi-Frobenius rings	158
	<i>Solutions to the Exercises on Chapter 5</i>	160
6.	Local homological algebra	
6.1	Notation	168
6.2	Projective covers	168
6.3	Quasi-local and local rings	170
6.4	Local Quasi-Frobenius rings	177
6.5	Modules over a commutative ring	178
6.6	Algebras	185
6.7	Semi-commutative local algebras	191
	<i>Solutions to the Exercises on Chapter 6</i>	197
	<i>References</i>	203
	<i>Index</i>	205