CONTENTS

ce	page vii
for the reader	ix
The language of functors	
Notation	1
Bimodules	1
Covariant functors	1
Contravariant functors	8
Additional structure	11
Bifunctors	12
Equivalent functors	14
lutions to the Exercises on Chapter 1	16
pplementary Exercises on Chapter 1	21
The Hom functor	
Notation	23
The Hom functor	23
Projective modules	26
Injective modules	30
i Injective Z-modules	32
Essential extensions and injective envelopes	35
lutions to the Exercises on Chapter 2	38
A derived functor	
Notation	53
A basic isomorphism	53
Some remarks on diagrams	62
The Ker-Coker sequence	62
Further properties of $\operatorname{Ext}^1_{\Lambda}$	66
Consequences of the vanishing of $\operatorname{Ext}^1_{\Lambda}(A, B)$	71
Projective and injective dimension	76
	The language of functors Notation Bimodules Covariant functors Contravariant functors Additional structure Bifunctors Equivalent functors Autions to the Exercises on Chapter 1 pplementary Exercises on Chapter 1 The Hom functor Notation The Hom functor Projective modules Injective Z-modules Essential extensions and injective envelopes Autions to the Exercises on Chapter 2 A derived functor Notation A basic isomorphism Some remarks on diagrams The Ker-Coker sequence Further properties of Ext ¹ _{\Lambda} (A, B)

vi	CONTENTS	
3.8	Λ -sequences	page 81
3.9	The extension problem	83
Solu	tions to the Exercises on Chapter 3	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
Solu	tions to the Exercises on Chapter 4	127
5. 1	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
Solu	tions to the Exercises on Chapter 5	160
6. I	ocal 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
Solutions to the Exercises on Chapter 6		197
Refe	rences	203
Inde	x	205