

Contents

	<i>Prologue</i>	<i>page ix</i>
1	Category Theory	1
	1.1 Categories	1
	1.2 Properties of Arrows	6
	1.3 Thinking in Terms of Arrows	8
	1.4 Functors	13
	1.5 Natural Transformations	18
	1.6 Properties of Functors	22
	1.7 Equational Reasoning	23
	Exercises	27
2	String Diagrams	33
	2.1 Composition of Functors	34
	2.2 Composition of Natural Transformations	36
	2.3 Converting between Symbols and Diagrams	40
	2.4 Equational Reasoning	45
	2.5 Natural Isomorphisms	50
	2.6 Duality	53
	Exercises	56
3	Monads	63
	3.1 Monads	63
	3.2 Monad Maps	67
	3.3 Comonads	70
	3.4 Kleisli Categories	72
	3.5 Eilenberg–Moore Categories	76
	3.6 Actions of a Monad	82
	Exercises	88

viii	<i>Contents</i>	
4	Adjunctions	91
4.1	Adjunction	91
4.2	Reasoning with Adjunctions	96
4.3	Composition of Adjunctions	100
4.4	Mates	102
4.5	Adjoint Comonads and Monads	106
4.6	Reflective and Coreflective Subcategories	108
4.7	Equivalences of Categories	110
	Exercises	123
5	Putting It All Together	129
5.1	Huber's Construction	129
5.2	Universal Constructions	136
5.3	Free Monads	146
5.4	The Resumption Monad	157
	Exercises	164
	<i>Epilogue</i>	167
Appendix	Notation	169
	<i>References</i>	174
	<i>Index</i>	179