## Contents

	Foreword		V
	Pref	ace	vii
1	Utility theory and insurance		1
	1.1	Introduction	1
	1.2	The expected utility model	2
	1.3	Classes of utility functions	7
	1.4	Optimality of stop-loss reinsurance	10
	1.5	Exercises	15
2	The individual risk model		19
	2.1	Introduction	19
	2.2	Mixed distributions and risks	20
	2.3	Convolution	28
	2.4	Transformations	31
	2.5	Approximations	34
			XV

## xvi CONTENTS

	2.6	Application: optimal reinsurance	39
	2.7	Exercises	40
3	Collective risk models		45
	3.1	Introduction	45
	3.2	Compound distributions	46
	3.3	Distributions for the number of claims	50
	3.4	Compound Poisson distributions	52
	3.5	Panjer's recursion	54
	3.6	Approximations for compound distributions	59
	3.7	Individual and collective risk model	60
	3.8	Some parametric claim size distributions	63
	3.9	Stop-loss insurance and approximations	67
	3.10	Stop-loss premiums in case of unequal variances	71
	3.11	Exercises	75
4	Ruin theory		81
	4.1	Introduction	81
	4.2	The risk process	83
	4.3	Exponential upper bound	85
	4.4	Ruin probability and exponential claims	88
	4.5	Discrete time model	91
	4.6	Reinsurance and ruin probabilities	92
	4.7	Beekman's convolution formula	95
	4.8	Explicit expressions for ruin probabilities	100
	4.9	Approximation of ruin probabilities	103
	4.10	Exercises	106
5	Premium principles		111
	5.1	Introduction	111
	5.2	Premium calculation from top-down	112
	5.3	Various premium principles	115
	5.4	Properties of premium principles	117

		CONTENTS	xvii	
	5.5	Characterizations of premium principles	120	
	5.6	Premium reduction by coinsurance	123	
	5.7	Exercises	125	
6	Bonus-malus systems		127	
	6.1	Introduction	127	
	6.2	An example of a bonus-malus system	128	
	6.3	Markov analysis	131	
	6.4	Exercises	137	
7	Credibility theory		139	
	7.1	Introduction	139	
	7.2	The balanced Bühlmann model	141	
	7.3	More general credibility models	149	
	7.4	The Bühlmann-Straub model	153	
	7.5	Negative binomial model for the number of car insurance claims	160	
	7.6	Exercises	166	
8	Generalized linear models		169	
	8.1	Introduction	169	
	8.2	Generalized Linear Models	171	
	8. <i>3</i>	Some traditional estimation procedures and GLM's	174	
	8.4	Deviance and scaled deviance	182	
	8.5	Example: analysis of a contingency table	186	
	8.6	The stochastic component of GLM's	190	
	8.7	Exercises	200	
9	IBNR techniques		203	
	9.1	Introduction	203	
	9.2	A GLM that encompasses various IBNR methods	207	
	9.3	Illustration of some IBNR methods	213	
	9.4	Exercises	220	

## xviii CONTENTS

10 Ordering of risks	223
10.1 Introduction	223
10.2 Larger risks	226
10.3 More dangerous risks	229
10.4 Applications	236
10.5 Incomplete information	245
10.6 Sums of dependent random variables	252
10.7 Exercises	265
Hints for the exercises	273
Notes and references	289
Tables	301
Index	303